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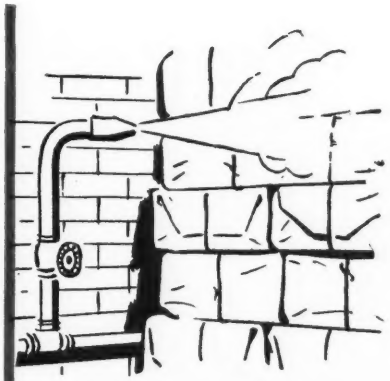
NO. 1
OF A SERIES
ON HOW TO

Stretch a MULTIWALL Paper Bag

It is just good business to get the best possible use from your multiwalls. Here is one way to do it . . .

Keep Storage Rooms Humid:



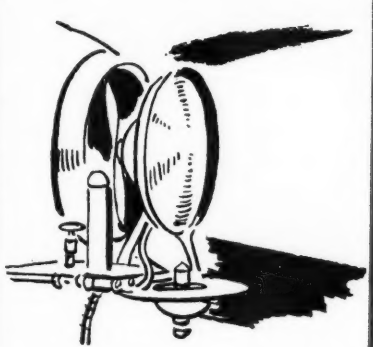
1. Let steam escape in bag storage room to keep air and bags humid. Keep a humidity indicator in the storage room and check it frequently. Always leave aisles or spaces between stacks of bags to allow circulation.

2. Store bags on dunnage, away from floor, and keep floor wet so moisture can be absorbed into air. A relative humidity of about 50% at warm temperature is best.

3. Drill small "needle" holes in horizontal water pipes. Hang cloths over holes. Air absorbs moisture from wet cloths.

4. Hang wet cloths over edge of water barrels. Cloth absorbs water and air absorbs moisture from cloth. Keep barrels well filled.

5. Open windows on damp or rainy day. Damp outside air will circulate in the bag storage room. Multiwalls are strongest when moisture content of the paper is about 6 or 7%.



6. Use commercial humidifying apparatus. Many types of commercial humidifiers are available with capacities to suit individual requirements.

Want the Whole Story?

Ask your Bemis Man for free, illustrated copy of Bemis Multiwall Packaging Guide. It deals with Storage, Filling and Closing, Handling, Palletizing and other important subjects.

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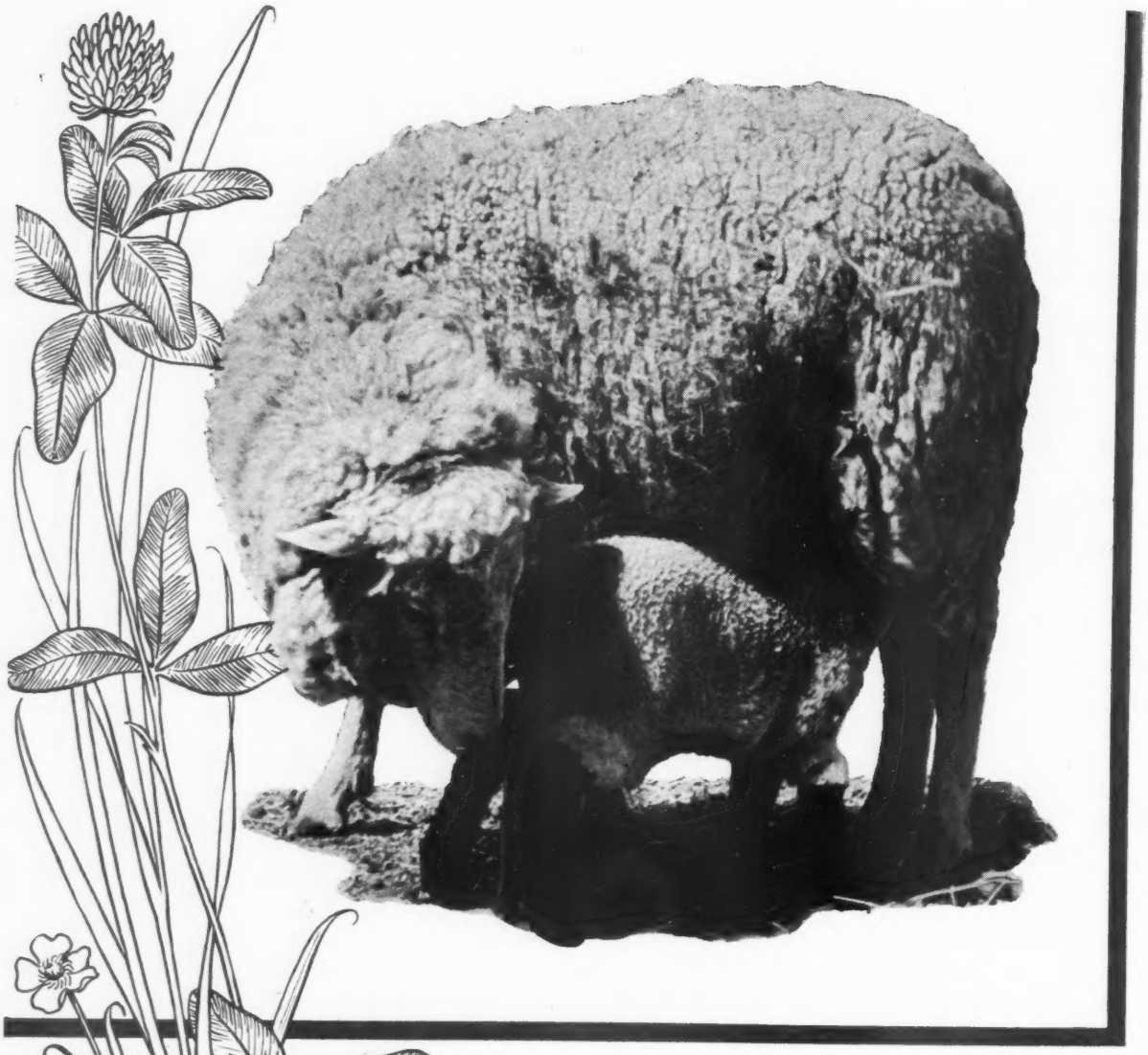
If you need cotton or burlap bags also, Bemis is your best source.

Bemis

BEMIS BRO BAG COMPANY

St. Louis 2, Missouri



A WHOLE FARM THRIVES ON NOURISHMENT

Each living thing on a farm — sheep, cattle, wheat — grows 24 hours a day. Stop and think what this means to a farm's natural resources.

You see, every form of growth must ultimately be traced to soil. And that means farms undergo a tremendous drain on the rich plant-food elements in the land.

That's where soil-replenishing fertilizers come in. Many of the most effective of these fertilizers contain POTASH . . . often Sunshine State Potash, a product of New Mexico. This fertilizer is *more* than a mere soil nutrient. It strengthens crops . . . thereby helping them to resist disease and drought.

SUNSHINE STATE POTASH A PRODUCT OF NEW MEXICO U.S.A.

REG. U. S. PAT. OFF.

HIGRADE MURIATE OF POTASH 62/63% K_2O
GRANULAR MURIATE OF POTASH 48/52% K_2O
MANURE SALTS 20% K_2O MIN.

UNITED STATES POTASH COMPANY, Incorporated, 30 Rockefeller Plaza, New York 20, N. Y.

In this issue . . .

Although there are many potent herbicides presently being used in agriculture for control of weeds, extensive work is under way to develop and test new compounds for possible herbicidal uses. One of these compounds, although not exactly "new," is shale oil, which gives promise of becoming an important farm chemical. Experiments in the use of shale oil as a herbicide were started in 1948 by the Wyoming Agricultural Experiment Station. Dale W. Bohmont, assistant agronomist at the station, describes the experiments in the article starting on page 12.

Thirteen years ago, Sven Nordengren prepared a paper on the possible development of the superphosphate industry. But the world had more pressing military problems at the time and the paper, which termed superphosphate the most important phosphatic fertilizer, didn't get presented. At last year's technical meetings in Paris, Nordengren revised the report and presented it at the International Superphosphate Manufacturers' Association meetings. According to the report, super still retains its leadership. For further details about the future of phosphatic fertilizers, see Nordengren's paper on page 17.

Pest Control Limited, of the United Kingdom, will give "Isopestox" another season of developmental work before putting it on the market, but already the material, a new and powerful pesticide, has shown important greenhouse application in the control of red spider, aphids and other pests. The new product, which has systemic and contact action, is described in detail in the article on page 22.

By getting a clearer picture of the pattern of root development in corn, cotton, tobacco and peanut crops in the Southeast, Prof. N. S. Hall, of North Carolina State College of Agriculture, has offered new and valuable information about the most advantageous placement of fertilizer for best plant benefits. Read about his work in the second report on radioisotope experiments on page 25.

Any dry grindable material can be pulverized to specifications if a "Pony" model mobile mill is used, according to Mead Mill company. An impact type pulverizer, the mill is the latest in the company's line. Structure of the machine and grinding data are included in the article on the product on page 60, along with information about the company's experimental laboratory for testing material.

farm chemicals

Formerly
American Fertilizer & Allied Chemicals

Established 1894

PIONEER JOURNAL OF THE FARM CHEMICALS INDUSTRY

Vol. 115 **MARCH, 1952** **No. 3**

Contents

Cover Story

That's not an oversized top on the cover, it's a conical dry blender—and the Patterson Foundry and Machine company, of East Liverpool, Ohio, claims it's the largest ever built. The unit is 13 feet in diameter, has a total capacity of 1,000 cubic feet and a working capacity in excess of 700 cubic feet.

A magazine international in scope and circulation and devoted to manufacturers, mixers, and formulators of fertilizers and pesticides

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RAYMOND MULTI-WALL PAPER SHIPPING SACKS melt away sales resistance to a new product

If you are marketing a new fertilizer, pack it in a Raymond Shipping Sack. That clean, fresh, attractive Raymond Fertilizer Sack will give your product a high quality look.

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THE RAYMOND BAG COMPANY, Middletown, O.

farm chemicals facts

. . . Briefly Noted

"Raincoats" for pesticides are the latest thing. A Jefferson, Iowa, amateur gardener has developed a new weatherproofing additive to hold pesticides on plants. The product is being offered commercially in both spray and dust form. Called **Plant Plate,** the product was announced by Frank Milligan, a lumber and grain man from Jefferson. He said he became interested in **weatherizing pesticide sprays** after rain washed them from his rose bushes.

The adhesive is a latex derivative, which Milligan added to fermate, DDT and rotenone and used successfully last season. He claims it is resistant to rainstorms, wind and heat.

James C. Totman, manager of the Bangor, Me., branch of **Summers Fertilizer** company, recently was elected president of Bangor City Council. At 31, he is the **youngest mayor** the city has ever had. Totman also is a member of the Maine state legislature.

New manager of the Insecticide division of **Naco's** plant at Charlestown, S. C., is **Albert Fuchs.** A member of the Naco staff since 1944, he has been assistant manager of the Charlestown branch since 1948.

Died: Harold A. Naugle, president of Consolidated Rendering company, January 22. He has been succeeded by **Leon E. Smith.** New treasurer of the company is **John H. Downing. Walter E. Meeken,** manager of the fertilizer department of the company, recently was elected to the board of directors.

Manager of nitrogen products sales in **duPont's** Polychemicals department, **John H. Daughtridge** has been appointed an assistant director of sales of the department. **Dr. Frank G. Keenan,** assistant manager of nitrogen products sales, was advanced to succeed Daughtridge. Both promotions were effective March 1.

After an absence of three years, **Otis G. West** has returned to **Fulton Bag and Cotton Mills** in New Orleans. West suffered a long illness on the west coast where he was transferred in 1948.

New sales-service representative for **Pennsalt** of Washington's B-K and Household Products Department is **Richard H. Fuller.** Fuller will have headquarters in the company's Berkeley, Calif., office.

Chemicals for farm and dairy sanitation and insecticides and weed killers for the farm are produced by the **B-K** division.

Jefferson Lake Sulfur company has started drilling additional exploratory wells for **sulfur** on the Black Bayou Dome, Cameron Parish, La. Wells already dug showed the presence of sulfur and formation conducive to the Frasch process, according to **Eugene H. Walet Jr.,** president of the company.

Chairman of the newly formed **fertilizer safety section** of the North Carolina State Safety Conference is **C. J. Watts Jr.,** assistant manager of the NACO Fertilizer company plant in Wilmington, N. C.

The new section was organized to strengthen and coordinate safety programs of fertilizer producers in the state.

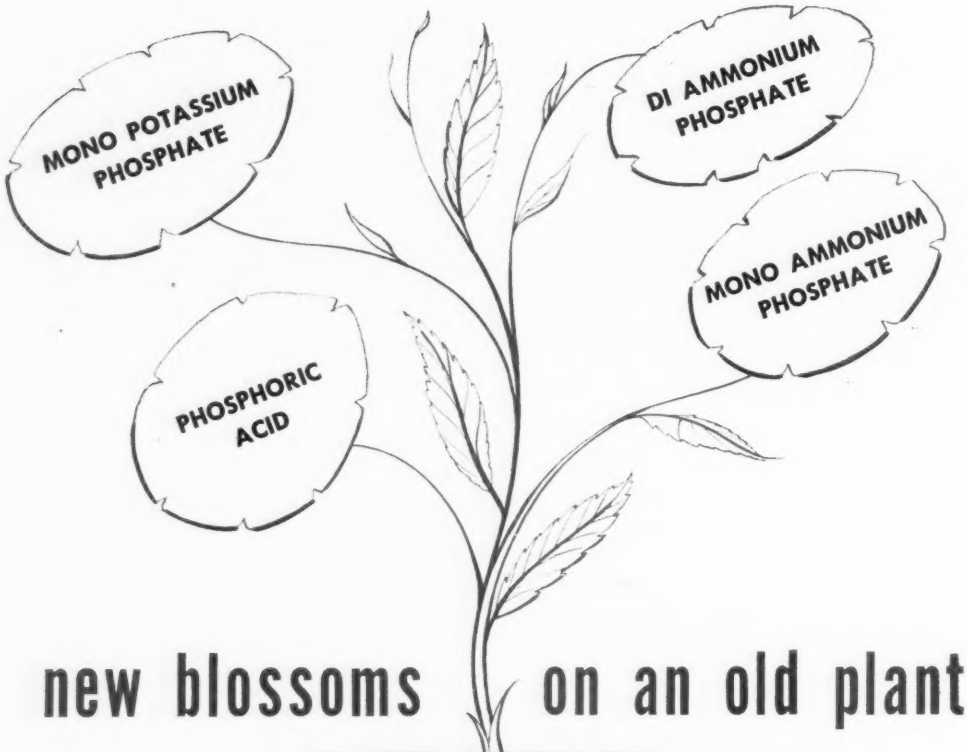
Installation of a **sulfuric acid plant** with a yearly capacity of 37,000 tons has been completed in an **Aberdeen, Scotland,** chemical works. All superphosphate requirements in North and Northeast Scotland will be met by the plant when it is in full production, it is reported. The process is based on **pyrites.**

In **France,** meanwhile, the Ministry of Industry and Commerce has made plans for construction of a three-kiln **sulfuric acid plant** with **gypsum** as the raw material. The sulfur shortage and the high price of pyrites are reasons for the contemplated construction.

Italian sulfur producers have attacked that country's policy of withholding refined sulfur export licenses to the **sterling area.** The producers claim sterling area countries always have been best customers for sulfur.

Three fertilizer manufacturers gave financial support to the sixth annual convention of the National Association of Soil Conservation Districts in Cleveland, February 25–29. The companies are **American Agricultural Chemical,** of Cleveland, **Miami Fertilizer,** of Miami, Ohio and **Virginia-Carolina Chemical,** of Cincinnati.

Because of a printing error, **J. E. Bedford's** name was omitted as the author of article on **safety committees,** page 29 of our January issue. Bedford is associate professor of merchandising at Armstrong College, Berkeley, Calif.



new blossoms on an old plant

MONSANTO
CHEMICALS — PLASTICS
Serving Industry . . . Which Serves Mankind

This is good news in agriculture and in industry. Increased availability of vital plant nutrients in the form of soluble inorganic salts for fertilizer solutions can mean new products and new markets for fertilizer manufacturers.

New emphasis is being placed upon WATER-SOLUBLE FERTILIZERS. Growers and manufacturers are developing new methods . . . new applications of high-analysis soluble plant foods which combine NITROGEN . . . PHOSPHORUS, POTASH and, in many cases, weed killers and insecticides, too.

MONSANTO, to help meet the increasing demands for plant foods, has increased quantities of four basic, soluble fertilizer chemicals . . . MONO AMMONIUM PHOSPHATE . . . DI AMMONIUM PHOSPHATE . . . MONO POTASSIUM PHOSPHATE . . . PHOSPHORIC ACID 75.0%.

New uses for WATER-SOLUBLE FERTILIZERS are proving profitable for growers . . . profitable for FERTILIZER MANUFACTURERS. Perhaps these products will fit into your production planning. Contact any District Sales Office, or write MONSANTO CHEMICAL COMPANY, Phosphate Division, 1700-A South Second Street, St. Louis 4, Mo.

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MONSANTO PLANT NUTRIENT CHEMICALS			
	N	P_2O_5	K_2O
Mono Potassium Phosphate (Crystals)	—0—	51.6%	34.2%
Di Ammonium Phosphate (Crystals)	21.0%	53.85%	—0—
Mono Ammonium Phosphate (Crystals)	12.2%	61.61%	—0—
Phosphoric Acid (75.0%) (Liquid)	—0—	54.5%	—0—

Wanted:

More Farm Chemicals

Agriculture is going places in a hurry. It has to. Every year there are more mouths to feed. In 1960 there will be 10 persons for every nine who were in the United States in 1950. In addition, tremendous amounts of foodstuffs are being shipped to foreign countries to aid starving peoples all over the world.

But farmers can't step up production of food for an expanding economy just with the snap of their fingers.

Many problems face them. Less and less land for agricultural purposes and the need for large amounts of food for military forces, for instance.

How has agriculture met this continuing expansion in the past? Through the use of farm chemicals—both fertilizers and pesticides.

One look at the United States Department of Agriculture's outlook for chemical fertilizer needs in 1955 shows the urgent problem which faces the fertilizer and pesticide industries in the immediate future.

If America's agricultural capacity is to be realized by 1955, the USDA reports 70 per cent more fertilizer will have to be provided by the industry.

Here's how the demand for the three basic soil nutrients shapes up according to the forecast for 1955:

Nitrogen—93 per cent more needed

Phosphoric acid—54 per cent more needed

Potash—77 per cent more needed

In actual figures, 900,000 more tons of nitrogen will be needed, according to USDA, and most of it in solid forms.

The need for phosphoric acid means that a total of 3,350,000 tons will be required three years from now.

Potash needs will total 2,100,000 tons by 1955, according to the department of agriculture.

Figures presented by USDA are not guesses, they are careful estimates made after a nation-wide study, tabulated from reports of state productive capacity committees in cooperation with the land grant colleges and USDA.

Some amazing increases in certain states will be necessary if agriculture is to be expanded to its required point in 1955. According to the USDA statistics, Maryland's total use of chemical fertilizers would increase 164 per cent; Indiana's, 117 per cent and Missouri's, 183 per cent.

Despite these overawing figures, there appears to be no cause for great alarm in the fertilizer industry.

In a letter to National Fertilizer Association members recently, President Russell Coleman stated that plant capacity expansion for most of the needed increase in nitrogen production already has been approved by the Defense Production Authority. The program for building some of the plants already is under way, he added.

The superphosphate picture also isn't as gloomy as it may seem. Present plant capacity for producing super is equivalent to approximately 3,730,000 tons available P_2O_5.

Coleman stressed the point that present superphosphate capacity is 180,000 tons above the estimated need for 1955. This optimism, of course, is tempered by the severe shortage of sulfur, which is so vitally needed in the production of the material.

The potash picture seems poorest of the three. Of the 2,100,000 tons needed in 1955, at least 1,750,000 will have to be produced in the U. S., with the rest obtained from imports.

Pesticide manufacturers have just as imposing a task facing them as the fertilizer industry.

Application of insecticides, fungicides, herbicides and other "icides" have shown the tremendous increases in crop yields they can guarantee by controlling insects, diseases and weeds on farms.

The following activities of the fertilizer and pesticide industries, the USDA and research workers throughout the country show what has been done and what must continue to be done—on a stepped-up basis—if the USDA's plans for 1955 are to be realized:

1. Development of new and more powerful fertilizers, soil conditioners and pesticides.

2. Efficient production techniques, especially in the face of critical shortages of raw materials for products and for construction of the plants in which they are produced.

3. Improvements in plant machinery and equipment for increased production and higher quality.

4. Research into the basic problems facing farm chemicals industries—such things as insect resistance to pesticides and more efficient placement of fertilizers for bigger and better yields.

The activities of two Connecticut scientists in solving the former problem and the work of the USDA in devising fertilizer placement machines for the second are described briefly in the Industrial News section of this issue of FARM CHEMICALS.

Only by such progressive activities can America's food basket be heaped to the record height sought by USDA in its far-reaching outlook for 1955.

—HAMILTON C. CARSON

farm chemicals outlook

Report from Washington
by Fred Bailey & Don Lerch

Washington is hopeful but not optimistic over prospects that farmers will meet this year's food goals. When pressed, officials admit they are gambling on favorable weather and good supplies of farm production essentials.

Farmers may upset their plans. There are few indications that farmers are going to take on a heavier load. Most reports point the other way.

Officials are disturbed. Many are accustomed to taking farm production for granted . . . something you turn on, like a faucet. This time Washington is shooting the works . . . asking farmers to set a new production record.

Inside story . . . USDA would have called for even greater production but total needs could not be fitted into available land. Goals were then cut back to fit the number of acres which officials believe can be put under cultivation. Even with the cutback, the target is for six and one-half million more acres under cultivation than a year ago.

The Department won't say it officially, but lack of price incentive is considered one of the key factors retarding all-out production. The spectre of OPS hangs over USDA planning sessions. Price fixers have served notice they will continue nailing farm prices to the party line. They have "taken the measure" of commodities currently far below parity.

USDA shies away from raising price props. Government officials and farm leaders still are fighting a defensive battle to sell consumers on the proposition that food prices are reasonable. To raise price supports is to touch off another round. Furthermore such a move probably would be vetoed by the White House as disrupting the stabilization program.

There is little steam in Congressional pleading for higher price supports. Cotton, a good barometer, is not due for a boost, according to a spot survey by FARM CHEMICALS here.

Cotton state congressmen would like Secretary Brannan to guarantee a higher minimum price . . . but don't intend to force him to do so. Brannan defends his position by forecasting similar demands from other commodity groups, including producers of feed grain . . . with resultant higher prices of meat.

While Washington argues . . . the farmers' net position is deteriorating. The farm price recovery trend which began last fall has lost momentum. Farm parity index has taken severe shocks.

Even the optimists won't predict a rise in farm prices during 1952, barring a bigger war. They are forecasting a rise in farm costs, however.

Growing peril of further government control of agriculture will be hurled at Congress during hearings on extension of controls. The Farm Bureau will demand the end of price controls. Grange spokesmen will base their arguments on elimination of controls on items which cannot be rationed.

Both are building cases on the danger of removing price fluctuations as the "governor" for maintaining a balanced pattern of farm production. With prices caught in a tight squeeze between "floors and ceilings" they fear more government "guidance". The two big farm groups are out to stop this trend.

USDA is selling record-production goals to farmers through every device available. Promotion program is centered on corn and other feed grains. Everyone is invited to lend a hand. Program will mount in intensity as corn planting season approaches.

The Department is dramatizing the production job by looking ahead to 1975 when planners say farmers must make five acres produce as much as six. By projecting the graph of population growth, they say we will need all we are producing now plus the production equivalent of the 10 states from Maryland and Delaware north to Maine. In terms of hogs, 1975 would require an increase equal to the output of Nebraska and Iowa . . . for milk, the production of Wisconsin, Michigan, and New York.

Major emphasis is being placed on fertilizer and pesticides. While other means of increasing production over this 25-year period are being pushed, fertilizer is singled out as "top priority".

Watch for mounting pressure in the field of phosphates. Having won the major battles for the establishment of a nitrogen expansion program designed to yield a 70 per cent increase by 1955, USDA is centering its efforts on superphosphate. More is being considered in top mobilization meetings.

USDA is not content to take a piece of the "sulfur pie" and scale its farm production program accordingly. Officials are building their case on the amount of food they believe is needed . . . then demanding the mobilizers find ways to get the "required" phosphates. The same procedure was followed in the nitrogen program.

Success by the Department in the phosphate program will mean substantial increases in production by methods other than the standard treatment of rock with sulfuric acid. This move can have a profound effect on the normal pattern of production. Officials want 56 per cent more superphosphate by 1955 "one way or another".

You'll be seeing more government reports telling how much more money farmers can make by using heavier applications of fertilizers. Although purchases of fertilizer usually parallel the farm income curve, the Department is out to prove consumption can set new highs. Industry has been striving for the same goal, with notable success, for many years and welcomes the sales help from the government.

How much fertilizer farmers should use, and the amounts they will buy still appear to be somewhat different, however. Part of the answer may be forthcoming this spring as farmers react to the requests for record production. In contrast to most areas of the South, fertilizer is pouring onto farms in the Midwest.

Pesticide producers are setting their own goals . . . in several cases new records. Their production is keeping abreast of the growing demand for most materials.

Export markets are becoming increasingly important for the steadily mounting production. DDT and BHC production are showing a tremendous increase. The rate of expansion in BHC has Washington blinking.

Elevator operators are being handed "greetings" by Food & Drug inspectors. Big nationwide drive is on to clean up insect infestations in small grain, chiefly wheat. Food & Drug says it means business. One of the problems is to decide between residues and bug parts.

The Army is backing an expanded program of fundamental research aimed at discovering the causes of insect resistance to repeated use of pesticides. Program is due to get underway this spring. National Research Council will coordinate the study.

Immediate results are not expected because of the nature of the work. However, the Army wants to know how resistance can be avoided, especially in the control of flies, mosquitoes and body lice. The generals know that insect-borne disease can take a higher toll than enemy bullets . . . or atomic bombs.

Home gardening program will not be expanded by the USDA. The Department has been subject to considerable pressure both pro and con. Officials plan to "stay in the middle".

One too many

Short supply is a happy state of affairs when a woman buys a hat.

In industry, too often it is a sword that hangs over the buyer's head. Executives who order more than 85 per cent of all Multiwall bags overwhelmingly specify* on-schedule delivery as the factor to which they give greatest weight.

Union Multiwalls are shipped from the world's largest pulp-to-container mill.

The pulp from which they are made comes from forests Union owns or manages. Your supply of Union Multiwalls is unlikely ever to be restricted because of raw material shortages.

When and if allocations are necessary, you can count on receiving your fair share.

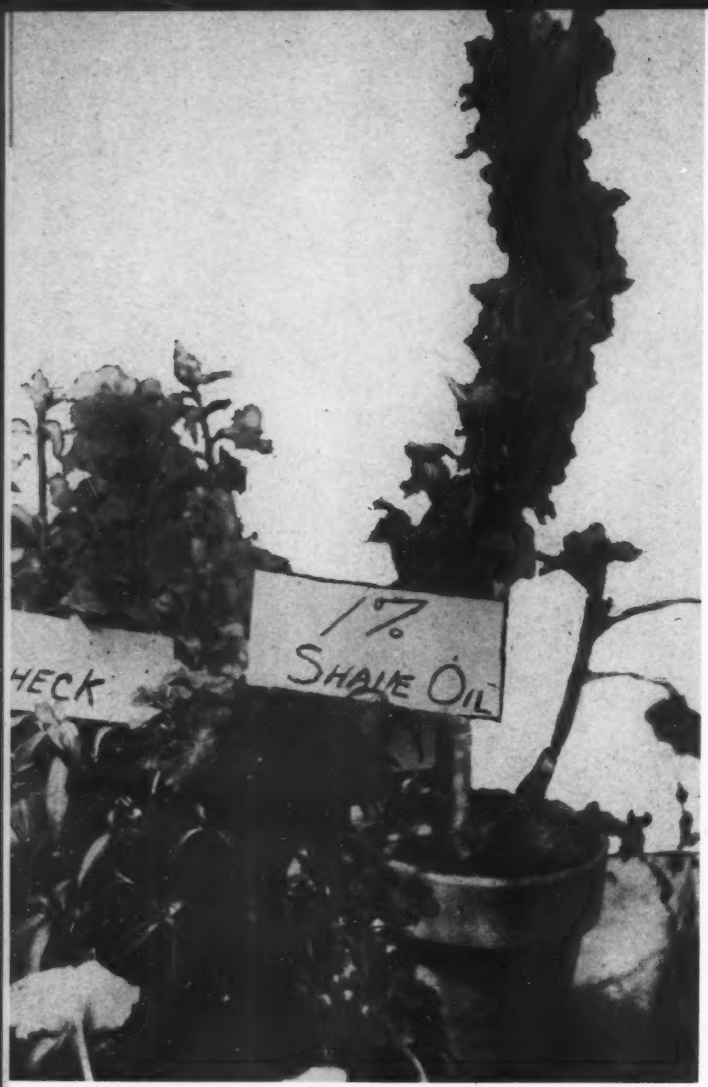
These are among the reasons why, since World War II, major buyers have given dependable Union so proportionately great an increase in their Multiwall orders.

More so every day . . .

IT'S UNION FOR MULTIWALLS

TRADE MARK UNION

**August, 1951 research study.*



Shale oil treatments of snapdragons showing increased flower stock length because of treatment. Experiment is observational and not tied down as to stage of plant growth for optimum response

Shale oil — will its double advantage make it become

A New Farm Chemical?

It is effective as a stimulant and as a contact herbicide

By Dale W. Bohmont

Asst. Agronomist,
University of Wyoming

THE search for a more efficient means of controlling weeds on agricultural lands has been the aim of agriculturalists since the beginning of crop cultivation.

The use of toxic chemicals as a method of weed control, however, is a rather recent innovation, having been used about the last half century.

It has been during the past ten years only that the true possibilities of chemical weed control have begun to be realized.

Through the development or discovery of markedly superior herbicides it has been possible to attain achievements in the weed control field never before anticipated. As a result, extensive work now is underway to develop and test many new compounds for their possible herbicidal properties.

Shale oil cannot be considered a "new" compound. In fact as early as 1694 a British patent records the distillation of an "oil from some kind of stone." But the concept of using shale oil as a herbicide never has been thoroughly investigated to date.

Although shale oil is not at present available in commercial quantities in the United States, investigation of the possibilities of a synthetic fuels program was inaugurated by the U. S. Bureau of Mines in 1944.

Since that time extensive studies and advancements in the refining processes and mining techniques for the production of crude shale oil now have made the production of liquid fuels economically sound.

The development and exploitation of the shale oil industry in the United States has been very slow because of the abundant supply of domestic petroleum and keen competition in the well-developed liquid fuels industry.

Because shale oil deposits are found in almost every country of the world, many of which do not possess a natural source of liquid fuels, shale industries have flourished in many foreign countries.

France and Scotland have been producing oil from shale on a commercial basis for more than 100 years and have been able to maintain economic stability through protective tariffs and the utilization of by-products such as ammonium sulfate.

Other countries such as Australia, Manchuria and Sweden have maintained a shale oil industry with varied degrees of success.

With the advent of World War II, the production from existing facilities was maintained and expansion was undertaken in many countries. Under the influence of the German occupation of Estonia during World War II, the production increased to 1,750,000 barrels of liquid fuels annually from the shale industry.

Extent of oil shale deposits is not generally known nor appreciated. Although shale is found in every state of the union, vast deposits of the rich Green River formation in Colorado, Utah, and Wyoming are by far the most important in the United States or Alaska. Based on information now available, it is estimated that Colorado's oil shale beds alone would yield nearly 500 billion barrels if all the oil were recoverable or about ten times as much oil as the entire world has used since oil was first discovered in Pennsylvania in 1859.

In view of ever increasing demands for petroleum in all countries, it seems logical that the establishment of a synthetic fuels industry based upon shale oil would be practicable.

Many Obstacles

Numerous obstacles still exist in the establishment of a commercial industry in the United States, but it may be only a matter of time before a thriving industry is established.

As in the development of any commercial industry the investigation and use of the by-products is an integral part. It is therefore of utmost importance that they be thoroughly explored.

Shale oil is not a single compound with a simple chemical formula, rather it is a complex mixture, the constituents of which have not yet been completely determined.

Approximate composition of shale oil naphtha as determined by the U. S. Bureau of Mines is the following:

30 per cent saturated hydrocarbons; 40 per cent olefins; 20 per cent aromatic hydrocarbons and 10 per cent sulfur, nitrogen, and oxygen compounds.

Greatest single difference between shale oil and straight run petroleum oils probably is the nitrogen impurities and the large amount of natural occurring olefins.

The nitrogen compounds are largely pyridine and pyrrole homologues and thought to be responsible for the gum forming characteristics as well as the marked purplish-brown color which is typical of raw shale oil fractions.

The author thinks shale oil has possibilities as a farm chemical because of its advantages, in large dosages, as a contact herbicide and in smaller quantities, as a plant stimulant, but he says much more research with the material is needed.

Investigations in the use of shale oil as a herbicide were started in 1948 by the Wyoming Agricultural Experiment Station in cooperation with the Petroleum and Oil Shale Experiment Station, U. S. Bureau of Mines.

For the purpose of determining herbicidal potentialities, the shale oil was conveniently divided into three fractions on the basis of boiling ranges. They are:

Naphtha, boiling range 70°F to 320°F; Kerosene, 320°F to 500°F and Gas-oil, 500°F to 700°F.

In preliminary screening tests, Great Northern bean plants were selected as indicators of relative injury caused by the foliage application of various volumes of shale oil.

The fractions were found to differ in the degree of phytotoxicity.

Higher boiling fractions were found to produce a chronic type of toxicity, the severity of which lasted often from 12 to 21 days after application. The naphtha fraction produced an acute type of toxicity, the severity of which lasted from 24 hours to four days.

By further separation of impurities of the shale, the resulting subfractions were found to vary in degree of damage to plants. The neutral portion of shale oil caused the least apparent damage in all fractions whereas the raw shale oil caused the most severe damage. Materials with the tar acids extracted were only slightly more toxic to plant growth than those fractions with the tar bases extracted.

Plant Damage

The 10 per cent emulsion of the naphtha fraction caused a plant damage equal to the five per cent emulsion of the kerosene fraction or a one per cent emulsion of the gas-oil fraction. Virtually all axillary buds of plants sprayed with non-lethal

Comparative greenhouse tests on Great Northern bean plants treated at seedling stage of development with fractional separations to the point of run-off. Note overproduction of blossoms, buds and fruits for small plant

Great Northern field beans treated at seedling stage of development. Note numerous buds and increased vegetative growth on treated plant, left. Treatment was two gals. per acre.

concentrations of shale oil began to develop shortly after the plants were sprayed.

By applying the information obtained from the screening tests it was apparent that shale oil caused a stimulative response on bean plants. Additional experiments were conducted to determine if the stimulation would have any practical field application.

Shale oil was applied to field beans at several stages of growth. The material was applied as an undiluted spray with a small plot spray especially designed for the experiment.

Seedling bean plants (prior to trifoliate leaf emergence) were found to be stimulated by shale oil sprays at volumes of two to ten gallons per acre. Through actual bud, blossom, and pod counts, an increase of 33 per cent was obtained, compared to the untreated control. Treatments often had an adverse effect on the production of buds, flowers, and fruits if the plants were treated at bud or later stages of growth.

Tumorous Growths

In more mature plants growth responses were manifested in the form of tumorous growths which appeared on the actively growing portions of the treated bean plants and in the development of numerous dwarfed leaves.

Field trials were established in Great Northern beans grown for commercial production. Treatments of large plots of Great Northern bean seedlings resulted in an increase of 25 per cent, or approximately 500 pounds, increase of dry field beans per acre.

This increased production probably was due to the increased number of fruits which developed normally on the treated plants.

While no practical application has been made of the dwarfing effect of shale oil on monocotyledonous plants, it may fit into an over-all scheme as one phase in the use of agricultural chemicals.

Since petroleum oils have been effectively used as selective sprays for the control of weed seedling in vegetable crops and for the control of annual weedy grasses in perennial grass turf, it seems logical that shale oil may be used in a similar manner.

Screening tests on 22 common annual broad-leaved and grassy weeds indicate that shale oil kerosene or gas-oil can be effectively used as a contact herbicide. The volumes needed will vary depending upon the age of the weeds which are to be treated.

In general, as the weeds become mature a heavier volume of oil is necessary for complete control. Some of the more susceptible annual herbaceous weeds such as marsh elder, kochia, lambs quarters and rough pigweed can be controlled with 20 to 40 gallons per acre of undiluted shale oil if the material is applied at the seedling stage of growth.

A volume of 40 to 80 gallons per acre may be required to control such weed seedlings as wild oats, Russian thistle and tansy mustard.

Onions and carrots are the most tolerant to foliage applications of shale oil and parsnips are the least tolerant of the vegetables tested. A volume of up to 40 gallons per acre of shale kerosene can be applied to established carrot seedlings for selective weed control without prolonged damage resulting to the vegetable crop.

Selective Control

Field application of undiluted shale oil of the kerosene or gas-oil fractions indicates that crabgrass seedlings can be controlled selectively in established lawns with very little damage to established bluegrass.

In comparative tests, the 60-gallons-per-acre of shale gas-oil were found to be equal to 140 gallons-per-acre of petroleum kerosene for the control of crabgrass seedlings. The naphtha fraction was not selective enough to be used as a spray for the control of annual grasses in perennial grass stands.

Spring treatments of 60-gallons-

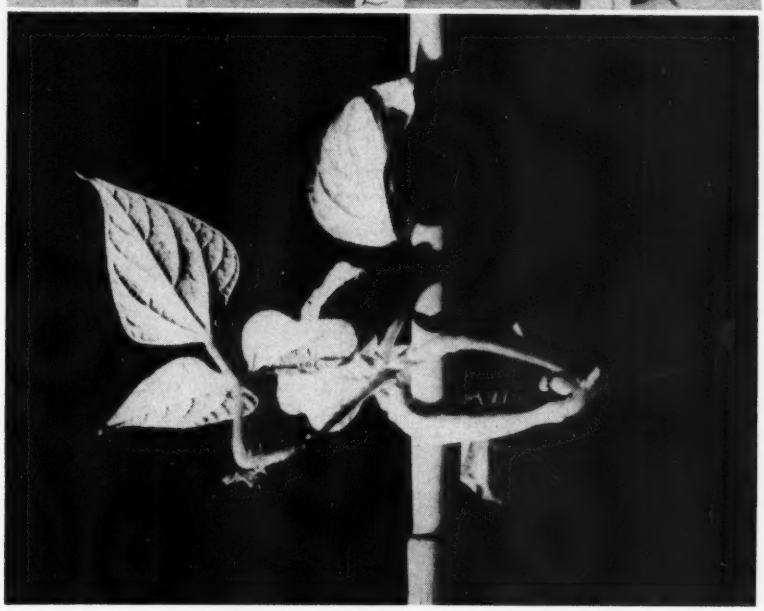
per-acre of gas-oil were more effective for the control of downy bromegrass (cheatgrass) in native pasture than fall applications. A control up to 95 per cent of the "weedy bromes" was obtained by spring treatments.

Fall application of a similar volume was 20 to 25 per cent less effective. Decrease in effectiveness probably is caused by germination of additional seeds after the fall application.

It is apparent that shale oil may be used as a contact herbicide at volumes of 40 gallons per acre or more. It may also be used as a plant stimulant in volumes of 10 gallons or less.

While the concentration, fraction and stage of plant growth need to be determined for many plants, it is possible for the stimulative response observed in several crop and flowering plants to have wide commercial application.

An increase in the number of fruits per plant by chemical applications is a new approach to the age old problem of increasing crop production. ◆



Top: dwarfing effects of two per cent emulsion of shale oil on seedling oat plants. (1) Untreated control; (2) Two-leaf stage, and (3) One-leaf stage

Middle: Great Northern bean plant treated in bud stage. Tumerous growths and abnormal growth often result from late treatments with oil.

Use of shale oil as a contact herbicide is shown in bottom photo. Treatments are (1) 40-gal/acre naphtha with 30 per cent control; (2) 60-gal/acre kerosene, 80 per cent; (3) untreated check, (4) 40-gal/acre kerosene, 60 per cent.

Sulphur

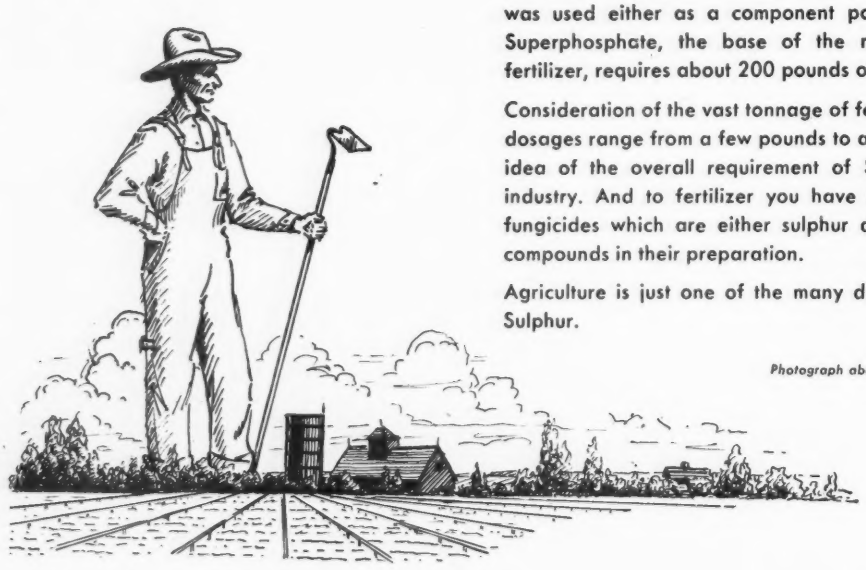
Thousands of tons mined daily, but where does it all go?

THE DEPARTMENT OF AGRICULTURE reports that in 1950 some 336,000,000 acres of land in the United States were under crop cultivation. That's a lot of acreage.

But where, you might ask, is the connection with Sulphur? Fertilizer, to take just one phase of agriculturally-used chemicals in which Sulphur was used either as a component part or as a processing element! Superphosphate, the base of the most widely used manufactured fertilizer, requires about 200 pounds of Sulphur for every ton produced.

Consideration of the vast tonnage of fertilizer used in agriculture — and dosages range from a few pounds to a ton or more per acre — gives an idea of the overall requirement of Sulphur for this one division of industry. And to fertilizer you have to add all the insecticides and fungicides which are either sulphur derivatives or have used sulphur compounds in their preparation.

Agriculture is just one of the many destinations of great tonnages of Sulphur.



Photograph above shows our loading dock at Galveston, Texas

Texas Gulf Sulphur Co.

75 East 45th Street, New York 17, N. Y.

Mines: Newgulf and Moss Bluff, Texas

The critical shortage of sulfur has caused many to wonder about

the future of

Phosphatic Fertilizers

By Sven Nordengren
Landskrona, Sweden

Paper presented at technical meetings of the International Superphosphate Manufacturers Association in Paris, September 25 and 27, 1951.

IN 1939 the author took part in the writing of a paper called "Possible Development of the Superphosphate Industry." It was to have been presented at a meeting of the International Superphosphate Manufacturers' Association in Hamburg, but the meeting was cancelled because of the outbreak of war. The paper subsequently was published in 1950.[1]

It called attention to the stable nature of the superphosphate industry. Although a century had elapsed since Liebig had suggested the treatment of bone meal with sulfuric acid and since Lawes had manufactured the first superphosphate on a technical scale, superphosphate still was being manufactured according to the original process and was maintaining its position as the principal phosphatic fertilizer.

The reason for this was simplicity of operation and cheapness of the process.

The paper then proceeded to refer to the competitors of superphosphate known at that time: basic slag, the principal competitor, Rhenania phosphate and other phosphates belonging to this group, such as "Basi"- and "Supra-Phosphate" sold in France and Belgium and the Russian "Thermo-phosphate," further dicalcium phosphate and ammonium phosphate. It also called attention to the trials made in America and Germany with thermal processes and the calcium metaphosphate produced in the United States.

In view of this competition, said the paper, an improvement in the quality of superphosphate should be regarded as desirable. The effectiveness of superphosphate is very low, because of the fixation of phosphoric acid in the soil. The paper pointed out that the effectiveness would be improved by granulation. A coating of the granules with a thin layer of dicalcium phosphate might prevent bag-rot and give the product better physical properties without diminishing its fertilizing effect. A reduction of the free phosphoric acid would be desirable. An improvement of the fertilizing value would result in a better utilization of all the other constituents of vegetation in the soil.

Most Important

After a further 12 years, superphosphate still is the most important phosphatic fertilizer, with basic slag as its chief competitor. Percentage of Western European (Organization for European Economic Cooperation) consumption of phosphatic fertilizers in 1948-49 was as follows:

Superphosphate	43.2
Basic slag	31.5
Ground phosphate rock	3.9
Other straight phosphatic fertilizers	3.9
Mixed and compound, water soluble	13.5
Mixed and compound, not water soluble	4.0
	100.0

Phosphatic fertilizer consumption has risen considerably during recent years. The consumption in West European countries in million metric tons P_2O_5 is:

Pre-war	1.65
1947–48	1.72
1948–49	2.03
1949–50	2.08
1950–51	2.31

It is considered probable that the demand will increase still further.

Better Quality

An improvement in the quality of superphosphate can be noted in some countries if the product (ordinary or concentrated) is delivered in a granular form. About half the Swedish superphosphate consumption, which is about 97 per cent of the total phosphatic fertilizers in use, is covered by granular superphosphate. Compound fertilizers also are being granulated in many countries.

A new factor which could not be foreseen in 1939 now threatens the

superphosphate industry: the world shortage of sulfur and sulfuric acid. There is considerably less sulfur imported into Europe from America. At the same time sulfuric acid is consumed in increasing quantities by other industries.

In view of this shortage it will be interesting to study the present situation regarding other phosphatic fertilizers than those manufactured with the aid of sulfuric acid. The processes by which these phosphatic fertilizers are manufactured can be grouped in the following way: (1) Basic slag process, (2) Nitric acid processes, (3) High temperature processes, and (4) Processes based on elementary phosphorus or phosphoric acid produced by thermal reduction.

1. Basic Slag Process

The basic slag process naturally belongs to the high temperature processes, but owing to the importance of basic slag as a phosphatic fertilizer and also to its character as a by-product, it should be treated separately.

The world production of basic slag was 850,000 tons in 1938, but fell to 600,000 tons in 1948–49. An increase is wholly dependent on an increase in the Bessemer steel production. It is not to be expected that a deficit in superphosphate production can be made up by basic slag.

2. Nitric Acid Processes

Sulfuric acid can be substituted by nitric acid. There is no great difficulty in breaking down phosphate rock by nitric acid if the temperature is kept low by cooling. A product can be obtained containing mainly monocalcium phosphate and calcium nitrate. The author has tried to drive off nitric oxides by heating in order to re-make the nitric acid, but unfortunately all the fluorine remains as calcium fluoride in the resulting product, and in the heating process the apatite molecule is re-formed.

Consequently the final product must contain nitrogen as well as phosphate. The best known of these processes are the following:

Nitrophoska process—This process was developed by the I. G. Farbenindustrie in Sondershausen, Germany, 1929. Phosphate rock was treated with nitric acid so that monocalcium phosphate and calcium nitrate were formed. Afterward a solution of potassium sulfate was added, reacting with calcium nitrate to form potassium nitrate and calcium sulfate. The product contained monocalcium phosphate, potassium nitrate and calcium sulfate. Sometimes ammonia was added.

Nitrophosphate process—This process was developed at Toulouse. Ground phosphate is treated with nitric acid in such proportions that phosphoric acid and calcium nitrate are formed. Part of the calcium nitrate is separated in crystal form and the mother liquor is mixed with ammonium nitrate and neutralized with ammonia.

Norsk Hydro process—Phosphate rock is treated with dilute nitric acid. After addition of ammonium nitrate and ammonium phosphate a product is obtained containing a double nitrate of calcium and ammonium, as well as mono-ammonium phosphate.

Undoubtedly there are other processes of this kind besides those mentioned here. The object of this report is to show that the treatment of phosphate rock with nitric acid leads to compound fertilizers, and that the processes lack the simplicity of the superphosphate process.

3. High Temperature Processes

There are two groups of such processes, one containing processes in which soda or sodium salts are used, the other in which solubility is attained by breaking down the apatite molecule at a very high temperature. Water vapor is the main reactive matter.

The processes of the first group all are based on the work of I. G. Wiborgh, Stockholm, around 1900, who found that a citrate soluble compound could be formed if phosphate rock was heaped to 800–1000° C. with about 40 per cent soda ash.[3] The best known of these processes are the following:

Rhenania process—Phosphate rock is sintered with soda ash and natural silicates at a temperature of 1200–1250° C. The product contains about 23 per cent citrate soluble P_2O_5. The annual output is said to be about 100,000 tons a year.

Lurgi process—Phosphate rock is treated together with large quantities of sodium sulfate, derived from the iron industry, at 800° C. The product is citrate soluble. The molecule built up is said to have not only sodium but also sulfur tied to the phosphorus radicals. Also in this case the production is limited being based on a by-product.

The second group of high temperature processes are based on the work of K. D. Jacob and co-workers in the Bureau of Soils of the United States Department of Agriculture, who first pointed out the effect of water vapor on phosphate rock at temperatures around 1400-1500° C.[4]

T. V. A. process—The Tennessee Valley Authority has developed a process for the defluorination of rock phosphate in an oil-heated shaft furnace.[5]

Phosphate rock, containing a certain amount of silica, is fused at a temperature of about 1550° C., the combustion gases containing an adequate amount of water vapor. The product is quenched in order to maintain its tricalcium phosphate in the citric acid soluble alpha-form, and at the same time granulated by high-velocity water jets.

Coronet process—Coronet Phosphate Company, Florida, has developed a process for defluorination of phosphate rock without fusion in rotary kilns.[6] The material is treated at temperatures about 1550° C. Because of a high content of silica the product is not fused. It is quenched by jets of water just before leaving the kiln.

Olivine Fusion process—It has been known for several years that if olivine or other minerals containing magnesium are added to the phosphate rock, the breaking down of the apatite molecule, which is present in all rock phospates, can be accomplished in a shorter time and at lower temperatures than if magnesium is absent. When magnesium is present magnesium fluoride is formed. This re-

action takes place more easily than the reaction through which hydrofluoric acid is driven off. The fusion can be performed in an arc furnace.

4. Elementary Phosphorus Process

(Processes based on elementary phosphorus or phosphoric acid produced by thermal reduction.)

Phosphoric acid processes—Elemental phosphorus can be obtained by the thermal reduction of phosphate rock in the presence of coke and a siliceous flux in an electric or blast furnace. It is burned to produce phosphorus pentoxide which is hydrated to phosphoric acid.

This acid can be used for the production of concentrated superphosphates or ammonium phosphate.

Calcium metaphosphate process—Phosphorus produced in an electric or blast furnace is burned to pentoxide which is forced up through a column of phosphate rock.[7] Phosphate rock and pentoxide react to form a slag mainly consisting of metaphosphate. Special methods of analysis are necessary to show plant solubility.

Other measures—As already described, many processes are available for the production of phosphatic fertilizers without the use of sulfuric acid. The bulk of superphosphate now produced and sold, however, is so large that a decrease and even a stand-still in the production of superphosphate at the present time will affect seriously the possibility of meeting a yearly increasing demand for phosphate fertilizers. Other measures have been suggested in order to make up the deficiency. Among other things, an increase in the use of finely ground phosphate rock, where soil and climatic conditions are suitable, has been recommended.

Position of the Industry

The dominating position of the superphosphate industry in the field of phosphatic fertilizers is threatened because of a possible chronic deficiency in sulfur or sulfur-bearing minerals.

There are considerable investments in the West European superphosphate industry. Taking the figures of 1950–51, 2.31 million tons P_2O_5 were sold in the O. E. E. C. countries. If half of this quantity were manufactured with the aid of sulfuric acid and if this quantity were calculated as 18 per cent superphosphate, the yearly production would be about 6.5 million tons.

New investments in the industry would now cost about $33.60 a ton of yearly production. Taking $16.80 as a conservative figure for all plants, new and old, investments in the superphosphate industry, including its sulfuric acid plants, would amount to about $109,200,000 in the O. E. E. C. countries.

What measures can the industry take in order to retain its leadership?

There seems to be only one answer to this question. Sulfur is used in making the product. This sulfur should be released and used again for the production of sulfuric acid.

This involves the necessity of making phosphoric acid so that the calcium sulfate can be separated. The consequence would be a production of concentrated superphosphate, at least so far as would be necessitated by the lack of sulfur.

The Missing Link

It is fairly well known how to make phosphoric acid containing 30 per cent P_2O_5.[8] This phosphoric acid can be concentrated to 45–50 per cent P_2O_5, after which concentrated superphosphate can be manufactured by letting the concentrated acid react with phosphate rock.

The manufacture of concentrated superphosphate can be performed in the ordinary superphosphate mixing units, which then will have a double capacity in tons of P_2O_5. The concentrated superphosphate can be granulated in ordinary granulating plants.

Recently it was found possible to make phosphoric acid of a concentration up to 45 per cent, in a direct way, according to the wet phosphoric acid anhydrate process.[9] There are specially constructed filters of the horizontal type suitable for filtering these concentrated acids without undue dilution.[10]

By centrifuging, the moisture of the calcium sulfate can be brought down to about three per cent, so that comparatively small quantities of heat would be required for its drying.

The missing link is a process which will enable even small superphosphate plants to recover sulfur from the calcium sulfate left as a residue when phosphoric acid is manufactured. It should be a cheap process giving SO_2-gas, not mixed with carbonic acid, so that the gas could be used in chamber plants. It would be better not to have this process combined with the production of cement, because it will be inconvenient to sell small quantities of such products.

If such a process could be invented, the superphosphate industry undoubtedly would keep its position as the leading producer of phosphatic fertilizers. ◆

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Red spider beware! Pesticide developed in England shows good test results. It's called—

Isopestox

By Hamilton C. Carson
Associate Editor

A POWERFUL pesticidal foe of redspider mite, aphids and other insects is in the final stage of development, with excellent test results reported.

News of the new pesticide comes from Great Britain, where it is being developed by Pest Control (United Kingdom) Limited.

It's called "Isopestox," and has received wide publicity in that country in preliminary testing against red spider and other insects, particularly in greenhouses.

Isopestox has systemic and contact action for the control of many other insects, including whiteflies, mealybugs, thrips, and scale insects.

Other benefits of the new pesticide, ascertained from preliminary testing are low toxicity, compatibility with many other pesticidal chemicals and persistent action. In addition very little of the applied dosage remains unchanged in the plant after three days.

Technically, Isopestox has the lengthy formula $PON_2C_6H_{16}F$. $(CH_3)_2$ CH NH_P O $(CH_3)_2$ CH NH F. It contains Bis (monoisopropylamine) fluorophosphine oxide.

The material is a white, odorless, tasteless crystalline solid in the pure state with a density of approximately 1.2. Its melting point is 60° C.

Solubility of the substance in water is low—about 8 per cent in water at room temperatures. Isopestox is very soluble in esters and other polar organic solvents, however. Stability is good: the material is slightly hygroscopic but indefinitely stable as dry crystals or in solution in dry esters. It decomposes more readily in acetone than in water.

Because Isopestox still is in the developmental stage (and will be for another year) the company makes no statement yet as to formulation or price.

Two Applications

The pesticide has a two-fold application, either as a foliage spray or watered on the soil. For the latter method, larger quantities of material are required than for foliage treatment.

Under normal growing conditions Isopestox is absorbed into the plant at the rate of 2 to 3 per cent of the applied dose per hour. To obtain the maximum insecticidal effect, 100 per cent absorption, rain must not follow within 36 hours of spraying where crops are treated in the field.

The persistence of the chemical was demonstrated in a test which showed that good control of aphids was obtained for periods of seven days following applications of from one to two pounds of the active material.

Residues are very small, tests by the radioactive tracer technique showing that residues in plants were of the order of two to three parts per million four days after the application of dosages as high as three pounds of active material per acre.

Experimental tests conducted by Pest Control Limited show effective control. In an application against the cabbage aphis (Previcoryn brassicae) on Brussels sprouts, the following results were noted:

With a dosage of one pound per acre, there was a 94.5 per cent reduction after one day and 87.8 after four days. With one-half pound per acre, results were 74.5 per cent reduction after one day and 73.3 after four days. Reductions of 56.8 and 51.8 per cent were noted after one and four days respectively, with a dosage of one-quarter pound per acre.

Test on Hops

Another test was made on hops for control of Hop Aphis. Here treatments with .05 and .025 per cent were made. Count of aphids after two, four and 19 days were none in the first test and one in each of the counts for the second treatment. A count for untreated hops plants showed 83, 51 and 34 insects in all stages for the three checks.

In the important tests against Red Spider, three experiments were conducted—on hops, tomatoes under glass and on peaches under glass.

In the first test, treatments of .05 and .025 per cent were employed with checks on total number of

spiders, number of adults and number of eggs after two, four and 10 days.

In the first treatment, the count for spiders of all kinds for the three checks was nine, nine and 76; for adults, three, two and none and for eggs, three, 62 and three.

In the second application, total spiders counted numbered 19, 16 and 43; adults, one, one and none and eggs, 61, 111 and one.

Untreated Plants

For untreated plants the count was much higher: total spiders, 80, 63 and 50; adults, 13, eight and eight and eggs, 25, 183 and 146.

In the test against the spider on tomatoes, only the lower two-thirds of the plants were treated, with counts made after two and four days of spraying.

In each count, total mites, percentage dead and percentage alive were noted. For the lower, or sprayed portion of the plants, these figures were 96, 96 and four for the first test and 109, 93 and seven for the second.

Counts for the upper, or unsprayed portions were respectively, 129, 180 and 20 for the first count and 114, 63 and 37 after four days. On untreated plants, 176 mites were counted, with 69 per cent dead and 31 per cent alive after two days, and 99, 37 and 63 for the second check.

In the experimental spraying of a peach tree, similar treatments were made as in the test on tomato plants. Because of the large number of mites present, counting was impractical. However, after four days, only one nymphal mite was found on five leaves of the treated part. There was no apparent reduction in numbers on untreated leaves, chemists reported.

As a result of these and other tests with Isopestox, the company believes the material is ideally suited for the control of aphids on many crops, including brassicae, lettuce, potatoes, peas, beans, sugar beets, flowers, seed crops, bush and tree fruit. In addition, research workers report, it appears to have excellent application for control of red spider on greenhouse crops, fruit trees and hops.

Suggested dosage rate for experimentation, according to Pest Control Limited, is between one-half and two pounds per 100 gallons of water plus wetting agent.

In the important field of toxicity, tests indicate an acute oral toxicity of 90 mgms/kgm for rats and guinea pigs. This compares favorably with several other pesticides.

Toxicity Data

Isopestox is nine times less toxic than nicotine, 26 times less toxic than parathion, and less than three times as toxic as DDT.

The company warns that although the substance is of much lower toxicity than other phosphorus insecticides, it is a cholingeric substance and precautions thus must be taken in handling it. Antidote for the chemical, as for other cholingeric substances, is atropine given under medical direction.

After completion of tests on many plants, the company reported no phytotoxicity observed on any of crops tested. ◆

Vivid illustration of effect of Isopestox in controlling red spider mite, aphids and other insects in greenhouses is shown in these photos of acalypha and chrysanthemum plants under treated and untreated conditions

Root distribution and

Fertilizer Placement

is studied with radioisotopes in one of the many 1951 projects

A CLEARER picture of the pattern of root development in four major crops in the Southeast—corn, cotton, tobacco and peanuts—is given in a report on experiments with radioisotopes by Prof. N. S. Hall, professor of agronomy at North Carolina State College of Agriculture.

The report is one of several contained in the digest of papers presented as a report to the fertilizer industry on soil and fertilizer investigations with radioisotopes.

Last month FARM CHEMICALS presented digests of three of the radioisotope papers. This month we present Prof. Hall's report and reports on the role of calcium in mixed fertilizers and the comparative rate and degree which orchard trees in the Northeast absorb phosphorus from fertilizer applied as leaf sprays and that placed directly in the soil.

The paper on calcium was presented by Dr. J. M. Blume, senior soil scientist, Bureau of Plant Industry, Soils and Agricultural Engineering, Beltsville, Md., and Dr. Hall.

Research on sprays was outlined by Drs. Russell Eggert, L. T. Kardos and R. D. Smith. Eggert is professor of horticulture, Kardos is associate professor of agronomy and Smith is a graduate assistant, all of the New Hampshire Agricultural Experiment station.

In the calcium paper, the Drs. Blume and Hall point out that only a small proportion of total calcium utilized by a tobacco crop is derived from the usual mixed fertilizer.

In the other paper, the research workers report that phosphorus from leaf sprays has the greater effect on current season's growth in fruit when applied to branches.

Dr. Hall's paper, which shows that corn, peanuts and tobacco would be benefited by high fertility 8 to 16 inches below the soil surface, follows:

Radioactive elements lend themselves very nicely to be used as tracers in studying the root distribution of plants. It is possible to locate radioactive materials in the soil and to observe when the plant roots get to these locations and also to note the feeding or activity of the roots. This second phenomena is probably much more important than the first. That is to say, it really does not matter whether a root gets to a certain point, but what is important is, "What does the root do after it gets there?"

Root studies have been made for the past two years at North Carolina State College utilizing radioactive phosphorus as a tracer, and corn, cotton, tobacco and peanuts as the indicator crops.

These studies have indicated some very interesting root patterns and extractions of horizons to varying degrees by these different crops.

In the first place, it was noted that when corn was grown on the Norfolk soil in 1950 and then again in 1951 on the Cecil soil that the root pattern and development were essentially the same. This was contrary to our expectation.

We assumed that the Cecil soil, which had a rather compact zone about eight to ten inches below the surface, would change the pattern of root development. Further the Norfolk soil was much more fertile than the Cecil and it was expected that this would also change the pattern of root development.

This indicates to us the possibility that root development is a characteristic of a variety (the variety used in 1950 was the same as that used in 1951). If this can be borne out by future studies, then we have an additional factor and a way of testing this factor to promote our plant breeding program.

Corn Roots

The progress of the corn roots throughout the soil during the first seven weeks appears to be in a hemispherical type of growth. At the end of two weeks the radius of this hemisphere is approximately 12 inches. Seven weeks after planting the radius apparently is in excess of 24 inches.

Studying the contribution of these various horizons, one finds that the three inch horizon has a very high contribution during the first five weeks but falls off very rapidly after the first two weeks. By the end of seven weeks, the three inch horizon has contributed approximately 40 per cent to the total growth, the eight inch horizon approximately 35 per cent, the 13 inch horizon about 20, and the 18

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LEAD ARSENATE Standard, Astringent, Basic

CALCIUM ARSENATE Standard and Low Lime

DDD Dust Base (50% DDD)

FERBAM Dust Base (76% Ferric Dimethyl Dithiocarbamate)

ZIRAM Dust Base (76% Zinc Dimethyl Dithiocarbamate)

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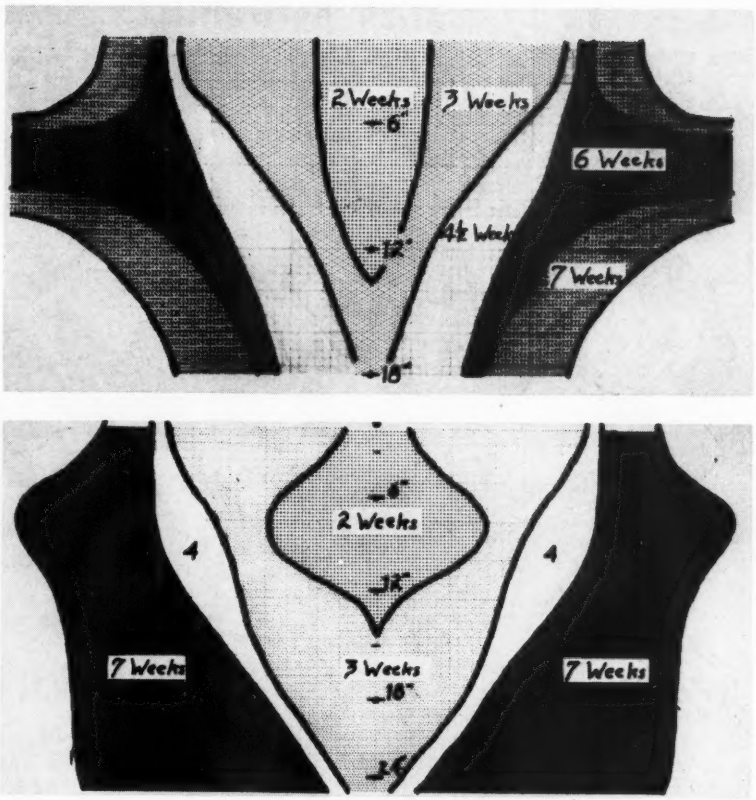
inch the remaining few per cent.

It is noted that the 13 inch horizon has rapidly increased from the fifth to the seventh week. Looking at the lateral contribution, or the contribution at various distances to the side of the plant, one notes that the roots located more than 18 inches from the plant are of little importance.

Turning to the cotton plant, one observes a different pattern. The initial four weeks' development of the cotton root is more or less dish shaped. Subsequent to that the tap root asserts itself and it extends below 16 inches. After that numerous side roots develop from 12 to 16 inches to the side.

The contribution of horizontal soil zones to the cotton plant is very interesting. It is noted that the four inch horizon contributes the most. By the end of the season the four inch has contributed approximately 60 per cent of the total uptake, the 12 and eight inch horizons approximately 20 per cent each, and the 16 inch horizon, while containing many roots, has contributed less than a few per cent.

The lateral or side contribution is, however, quite different. Here it is observed that the roots do not extend in much quantity greater than eight inches. By the end of the season, it is observed that the zero, four, and eight inch distances to the side are contributing about equal. The 12 and 16 inch distances to the side contribute less than 10 per cent.



Time required for tobacco roots, upper, and peanut roots to arrive at a given location. Lateral distance is 36 inches in top photo, 48 in lower.

Tobacco Root

The tobacco root system is typified by a tap root that extends rather rapidly reaching 16 inches in less than 20 days. Five weeks after transplanting a rather rapid lateral growth at the eight to 10 inch level begins and continues for a period of two or three weeks. This is reflected in the contribution of horizons in that the four inch horizon drops off very rapidly after the second week, whereas the eight and 12 inch horizons ineight and 12 inch horizons increase in their relative contributions.

At the time tobacco normally is primed, the eight inch horizon has contributed 40 per cent. The four, 12, and 16 inch horizons are equally contributing the remaining 60 per cent.

The fact that tobacco can be closely planted is illustrated by the data on the contribution of the roots to the side of the plant. These data indicate the roots directly below the plant contributed about half of the total. The roots four inches to the side contributed about 20 per cent. The remaining 30 per cent was distributed among the eight, 12, and 16 inch lateral distances.

The peanut shows another type of root development with a very rapidly extending tap root and little growth to the side. The eight inch horizon contributes more than 60 per cent to the plant. The 16 and 24 inch horizon contributes less than 10 per cent. The lateral growth of roots has been very small. The tap root directly under the plant contributes over 80 per cent of the total uptake of the plant. The contribution from 12 inches to the side is about 5 per cent or less.

Summarizing, one might say that these studies indicate a manner of locating the plant roots and knowing their contribution. In this manner, we can have a better idea as to where to put the fertilizer and how much to put in at the relative depths.

It now remains a problem as to how we are going to get the fertilizer at the deeper depth. The studies indicate that with the exception of cotton, these plants should be benefited by a high fertility condition at the eight to 16 inch levels.

Calcum Paper

Only a small proportion of the total calcium utilized by a tobacco crop is derived from the usual mixed fertilizer, according to the report by Drs. Blume and Hall. Their experiments with the role of calcium in mixed fertilizers as a plant food are presented in the paper, which follows:

Many of the soils of the eastern United States which are low in calcium are used for crops which re-

To Dramatize Agriculture's Need for Nitrogen

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MEET "MR. N"—new symbol of Nitrogen, introduced this month by Spencer Chemical Company.

Grow-Power for Farm Crops with NITROGEN!

SOON YOU WILL SEE Spencer Chemical Company's "Mr. N," new symbol of the grow-power of Nitrogen! Designed for Spencer by the well-known artist, Arthur Kraft, "Mr. N" makes his debut on the front of each new bag of Spencer Ammonium Nitrate fertilizer. Look for him there! And remember: Nitrogen is in tremendous demand this year, so advise your customers to use it wisely.

LOOK FOR "MR. N" on your next bags of Spencer Ammonium Nitrate fertilizer. He symbolizes the *grow-power* of Spencer Nitrogen!

MORE CORN. Field at left yielded 95.7 bushels after getting 200-250 lbs. of nitrogen fertilizer, plowed down, and 120 lbs. of 4-24-12 in the row. Field on right received 200 lbs. of 0-18-0, plus 145 lbs. of 8-8-8 in the planter; yielded but 44.5 bushels.

MORE WHEAT. Near Cheney, Kansas, Keith Foley came out 200 lbs. short on nitrogen fertilizer. Note the result: Wheat that received no nitrogen (shown at right) produced 9.7 bushels. The portion that got nitrogen (at left) yielded 20.0 bushels.

MORE PASTURE. By topdressing ammonium nitrate fertilizer in the fall and spring, J. B. Spears and Sons of Covington, Ga., grazed 225 head of mature beef cattle from October thru March on 140 acres of fescue and Ladino clover!

RESEARCH AND DEVELOPMENT work in the fertilizer field is carried on by these 5 Spencer Chemical Company agronomists. Perhaps one of them can help *you* solve some fertilizer problem. As with Spencer Technical Services personnel, there is no charge.

SPENCER® Supplies the Nitrogen

33.5% Nitrogen—Fertilizer Grade Ammonium Nitrate—Spencer Nitrogen Solutions for Famous Brands of Mixed Fertilizers.

quire rather heavy fertilization.

While the fertilizer applications are almost always made for the purpose of supplying nitrogen, phosphorus, and potash, the materials used often contain considerable amounts of calcium. Mehring has estimated that the average CaO content of mixed fertilizer is about 17 per cent.

On that basis, 1,000 pounds per acre, which is not an unreasonable application, would supply about 170 pounds of CaO. This is a sizable addition of calcium to a low calcium soil, and one might therefore expect the fertilizer to contribute an important fraction of the calcium used by the current crop.

Since a field experiment with radiocalcium offered some possibility of determining whether this were true, a test was designed and carried out to study this and related questions. The study was made cooperatively by the Bureau of Plant Industry, Soils, and Agricultural Engineering, U. S. Department of Agriculture, and the Agronomy Department of North Carolina State College, and was supported, in part, by industry funds.

The main objectives were as follows:

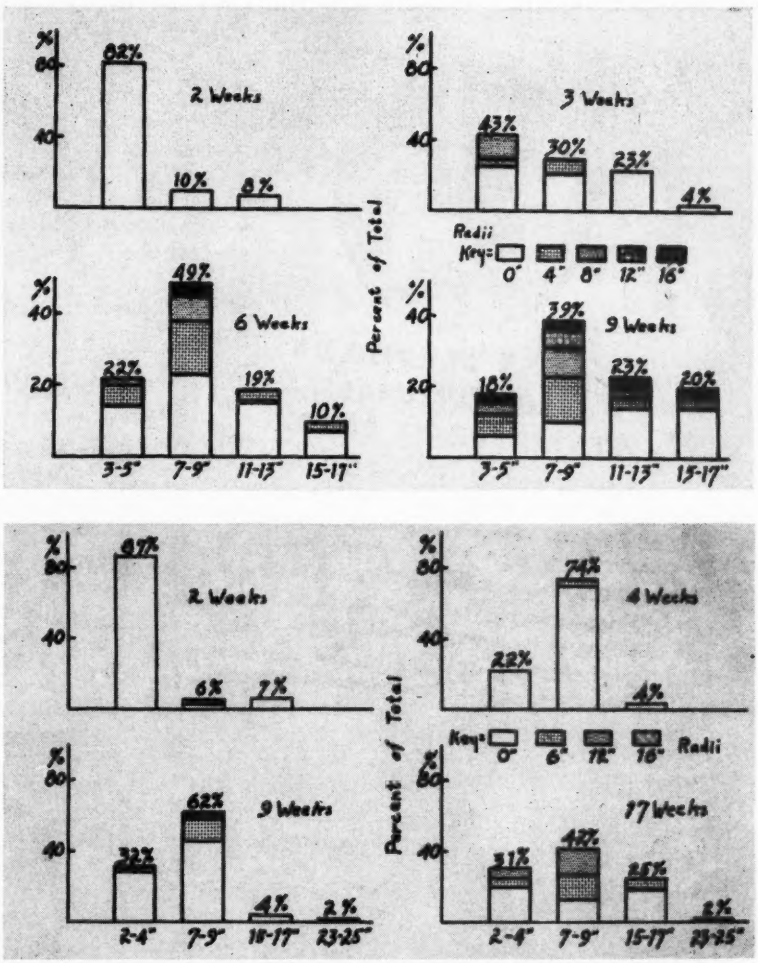
1. To estimate the fraction of plant calcium originating from each of the three sources of calcium (monocalcium phosphate, gypsum, and calcium carbonate) in a typical tobacco fertilizer.

2. To estimate the fertilizer contribution to the tobacco plant's calcium at each of several stages of growth and to determine the distribution of the fertilizer calcium within the plant.

3. To compare the utilization of calcium and phosphorus from monocalcium phosphate.

4. To evaluate the hazards of field application of radiocalcium by tracing the movement of the labeled compounds horizontally and vertically in the soil, and by recovery of Ca^{45} in crops grown after the tobacco crop.

The soil upon which the plots were located was a Norfolk fine sandy loam, *p*H 5.8, exchange capacity 2.4 m.e./100 gm., 67 per cent saturated with bases, and containing about 650 pounds CaO per acre to plow depth.



Graphs for tobacco, upper, and peanut indicate the relative contribution of the roots of these crops. Different bars indicate various horizons, while shaded area within bars indicates amount of nutrients drawn from each root location. Figures under bars indicate soil depth.

The experiment consisted of 14 treatments, each replicated three times. Each plot was a single row of tobacco 20 feet long. Nitrogen and potash fertilizer was mixed with the soil while the calcium and phosphate compounds were applied in three bands three inches apart and three inches below the surface, the center band being directly under the plant.

Plants Set Out

The plants were set out the day after fertilization of the plots.

The treatments differed from one another according to the material labeled with Ca^{45} or P^{32}, and according to the location of the labeled material.

Harvests were made 14, 31, 45, 59 and 82 days after transplanting, each of the last two harvests being separated into several fractions based upon location of the leaves on the plants.

After drying and grinding, the plant material was analyzed for Ca^{45} and total calcium, or P^{32} and total phosphorus, as the case might be, and the specific activities of the plants compared to the specific activities of the fertilizer materials in order to calculate the fraction of the nutrient in question derived from the fertilizer.

Detailed reporting of the results must await statistical analysis of the data. However, certain trends are evident and warrant preliminary conclusions. In the paragraphs below these conclusions are given.

1. The fraction of the plant's

calcium originating from monocalcium phosphate is low compared to the fraction of the plant's phosphorus originating from this same compound.

2. Uptake of calcium by plant from monocalcium phosphate, calcium sulfate and calcium carbonate was greater when these materials were applied in three separate bands than when mixed together in one band.

3. Separate band application of monocalcium phosphate, compared to application of monocalcium phosphate mixed with calcium sulfate and calcium carbonate, showed greater utilization of phosphorus from the former treatment.

4. Application of monocalcium phosphate in a side band resulted in a relative accumulation of both calcium and phosphorus from this material in the side of the plant directly above the plant.

No Movement

5. Three months after application of the labeled monocalcium phosphate, calcium sulfate, and calcium carbonate in bands, during which period the plots received 14.5 inches of rain, no evidence could be found of movement of calcium as far as three inches laterally, or four inches vertically.

From a more or less practical viewpoint, one might conclude that it is unnecessary to use mixed fertilizers with a high calcium content, since calcium as a nutrient is utilized more efficiently when mixed with the mass of soil than when applied in bands.

In the other paper information on the comparative rate and degree in which orchard trees in the Northeast absorb phosphorus from fertilizer applied as leaf sprays and that placed directly in the soil was presented.

Results show that phosphorus from leaf sprays has the greater effect on current season's growth in fruit on the sprayed branches.

Northeastern region experimental objectives:

1. To determine whether apple trees can absorb and translocate phosphorus that is applied to their leaves in foliar sprays.

2. To find which of several phosphorus salts is absorbed most readily by apple leaves.

3. To determine the comparative rate and degree of absorption of phosphorus from foliar sprays and from soil applied phosphates.

Preliminary experiments were carried out in the greenhouse to determine objectives one and two. For this work 30 uniform one-year-old trees of Malus Robusta were grown in gallon cans. They were divided into six groups of five trees each. Five control plants were left unsprayed.

The phosphorus salts, one of which was sprayed on each group were mono-ammonium phosphate, di-ammonium phosphate, di-sodium phosphate, tri-sodium phosphate and mono-calcium phosphate. Solutions used contained one gram P_2O_5 per liter with a specific radioactivity of approximately 0.00384 millicurie per milliliter.

Each five plants received 125 milliliters of solution or approximately 0.48 millicurie of P^{32}. The lower half of the top of each tree was sprayed. Plastic covers prevented contamination of soil and the upper unsprayed half.

The magnitude of the deposit of phosphorus on sprayed leaves, and accumulation in unsprayed leaves was determined by removal of 15/16 inch leaf discs at intervals of one week.

Radioactive counts on discs of both new and old leaves from unsprayed parts of the trees show a fairly uniform increase in phosphorus during a twenty-eight day period. Di-ammonium phosphate was absorbed and translocated in largest amounts, particularly to young leaves.

Final analyses of unsprayed new leaves and stems, unsprayed old leaves and stems, and roots were made to determine the percentage of P_2O_5 they absorbed from the fertilizer. The largest percentage, 3.2, came from the di-ammonium phosphate, 2.7 from di-sodium phosphate, 2.3 from mono-ammonium phosphate, 2.2 from mono-calcium phosphate and 2 from sodium phosphate.

Further results show that when spray was applied in the above manner and location, about 2.5 times as much was absorbed and translocated to the roots as to the new leaves and twigs, and roots received about two times as much as did old leaves and twigs. These values were obtained from a single application of the spray solution which contained only 0.8 mgm. P_2O_5 per milliliter and which deposited only approximately 0.0013 mgm. P_2O_5 per square cm. of leaf area sprayed.

Three limbs on each of six 25-year-old McIntosh apple trees in full production were sprayed with 60 ml. of di-ammonium phosphate with a concentration of 1.0 mg. of P_2O_5 per liter and a specific activity of 0.008 millicurie per milliliter. Ends of the limbs were left unsprayed. The deposit of P_2O_5 on the leaves from the spray was approximately 0.0006 mgm. per square cm. of leaf area.

Absorption of the foliar spray was greatest in the current season's terminal growth which developed out of sprayed tissue, and by fruit that grew on sprayed limbs. The small amount of P_2O_5 applied appeared to travel in specific absorption and translocation channels.

Counts made on sprayed leaves after a one-inch rain which occurred nine days after the application of the foliar spray indicate that relatively small amounts of the applied phosphate were lost by leaching.

Applied to Soil

The absorption by apple trees of phosphate applied to the surface of the soil at rates equivalent to 500 pounds per acre was studied in relation to the extent of penetration of the soil applied phosphate. An excellent correlation was indicated between depth of penetration into the soil and the amounts of phosphate from the fertilizer in the fruit and leaves.

Where there was no measurable penetration of the phosphate below the 0–2 inch level there was no measurable amount of fertilizer phosphate in the leaves and fruit at harvest time.

Where penetration of the fertilizer into the 6–8 inch layer occurred there was almost twice as much phosphorus absorbed from the fertilizer as where the penetration was only into the 2–4 inch layer. ◆

FERTILIZER MATERIALS MARKET

New York

February 27, 1952

Sulfate of Ammonia

While producers are sold out for the current year, fertilizer manufacturers are not taking the material out on contract as fast as the producers would like them to take it. This is caused mostly by lack of storage space and the fact that the farmers this year are slow in taking delivery of fertilizer. No price changes were noted.

Ammonium Nitrate

This material was in heavy demand and producers were shipping material as fast as production would permit against existing contracts. Demand was heavy from various parts of the country.

Nitrogenous Tankage

With leading producers sold up and withdrawn from the market, nitrogenous tankage was hard to obtain for prompt shipment. There were a good many inquiries in the market and some foreign material was offered for future shipment at prices considerably higher than the domestic market.

Castor Pomace

This material was still in demand on basis of last sales which were $37.25 per ton, f.o.b. shipping point, guaranteed 6.75 per cent ammonia. No recent offerings have been made and producers are shipping against previous sales.

Organics

Some organic fertilizer materials showed some signs of easement for the first time in several months because of the slump in the feed business at the present time. Soybean meal mixed with some other ingredient was available at prices around $90 per ton, f.o.b. Decatur, Ill., in bulk for sale on a mixed feed basis. No offerings of linseed meal were noted but there were some scattered offerings of cottonseed meal at ceiling prices. Tankage sold at $8.00 per unit of ammonia ($9.72 per unit N) and blood at the same price, f.o.b. Eastern Points.

Fish Meal

While practically no menhaden fish meal was available, offerings of imported material were made from time to time on basis of $2.26 per unit of protein, which is the ceiling price, and figured out to about $135.00 per ton at the port. Demand continued fair, mostly from the feed trade.

Bone Meal

With feed demand off slightly, it was thought there might be some easing up of supplies but so far this has not materialized. Offerings of fertilizer bone meal, both steamed and raw, are very scarce and hard to obtain at reasonable prices.

Hoof Meal

Little trading was reported in this material recently with last sales on basis of $7.25 to $7.50 per unit of ammonia ($8.82 to $9.12 per unit N), f.o.b. domestic shipping points.

Superphosphate

While this material was still in short supply, buyers seemed to be in no hurry to take delivery of material they had already purchased. The situation, however, should remain tight over the next 60 days. Triple was said to be very scarce.

Potash

This material was still being shipped against old contracts with the producers sold out for this year, but here again shipping instructions were a little hard to obtain becaus of lack of storage space at buyers' plants.

Low Grade Ammoniates

A good supply of this class of material was noted with no shortages reported and producers able to supply buyer's wants.

Philadelphia

February 27, 1952

The demand for raw materials is considerably reduced and the general market is not too strong. Blood and tankage are appreciably weaker, but bone meal is still in strong demand. Calls for deliveries against standing contracts for potash, superphosphate and hard nitrogen have eased up to an unusual extent for this season of the year. It is reported that in some sections the price of complete mixtures has been reduced and growers are exceedingly slow in ordering out their fertilizer.

Sulphate of Ammonia.—While the market is still nominally tight, the demand is easier and calls for contract deliveries are by no means urgent. Resale material is beginning to appear but not much buying interest.

Nitrate of Soda.—Inquiry is seasonal and the market is reported firm with no price change. Stocks are ample to meet all present needs.

Cyanamid.—Some of the granular grade was offered recently at $72.00 per ton, but the quantity was limited.

Blood, Tankage, Bone.—The demand for blood and tankage is very much easier and prices quoted range from $7.50 to $8.50 per unit of ammonia ($9.12 to $10.33 per unit N), depending on location. Bone meal is still scarce at about $85.00 per ton for steamed grade and $75.00 for raw meal. Hoof meal enjoys a little more interest at $7.25 to $7.50 per unit of Ammonia ($8.82 to $9.12 per unit N), Chicago basis.

Castor Pomace.—There are no offerings at this time.

Fish Scrap.—Market remains devoid of domestic offerings but considerable imported fish meal is ar-

riving at $2.26 per unit of protein, which is ceiling price.

Phosphate Rock.—Production is now taking ample care of the domestic demand, but the higher grade rock for export is said to be somewhat tight.

Superphosphate.—While calls for contract deliveries have slackened quite a bit, the market position continues to be reported exceedingly tight. However, it begins to look as though the critical supply shortage heretofore predicted will not be too severe.

Potash.—Production is well able to meet the demand which has dropped considerably and stocks are said to be accumulating

Charleston

February 26, 1952

The movement of mixed fertilizers in the Southeast has been slow to get started but now is tending to expand. It appears that the season will be short and fast as compared to previous seasons. Nitrogen and superphosphate continue in tight position with potash supply in relatively good balance with demand.

Organics.—Spot organics for fertilizer use are rather scarce and the producers of domestic nitrogenous are in a heavily sold position. Prices of domestic nitrogenous vary nominally from $4.25 to $4.90 per unit of ammonia ($5.16 to $5.95 per unit N), bulk, f.o.b. production points. Limited sales of imported nitrogenous have been made recently at $6.00 to $6.25 per unit of ammonia ($7.29 to $7.59 per unit N), in bags, c.i.f. Atlantic ports.

Castor Pomace.—Production of castor pumice continues very light and supply is in heavy demand at $37.25 per ton in burlap bags, f.o.b. Northeastern production point, with $2.00 per ton allowance if shipment is in paper bags. This is guaranteed minimum 6.75 per cent ammonia. Light offerings of imported castor pomace range from $46.50 to $49.00, c.i.f. South Atlantic ports.

Dried Blood.—South American dried ground blood is offered in limited quantity for spring shipment at around $8.60 per unit ammonia ($10.45 per unit N), in bags, c.i.f. Atlantic ports. Unground dried blood, in bulk, is indicated at $8.25 per unit of ammonia ($10.02 per unit N), f.o.b. Chicago area and at New York, interest is weak at $8.50 ($10.33 per unit N).

Potash.—Movement to fertilizer manufacturers is steady and tending to increase with seasonal demand. Price remains firm and unchanged.

Ground Cotton Bur Ash.—This form of potash, primarily carbonate of potash, continues available in fair quantity for prompt and future shipment. Best productions test 40 per cent K_2O and deliver at prices comparing favorably with sulfate of potash.

Phosphate Rock.—This market is fairly tight, with demand strong from domestic users but supply is expected to be adequate.

Superphosphate.—This market continues extremely tight with demand far in excess of supply. Practically all output is under contract. Prices remain at ceiling levels.

Sulfate of Ammonia.—Pressure has eased somewhat due to heavy stocks of fertilizer materials in mixer plants but as the movement of mixed goods picks up, demand is expected to tighten the market. Prices remain firm and unchanged.

Ammonium Nitrate.—Canadian material continues priced at $72.50 per ton, f.o.b. Port Robinson, Ontario, and domestic material at $63.00 to $64.00 per ton, f.o.b. works. Demand is exceedingly heavy.

Nitrate of Soda.—Demand is expanding somewhat with seasonal call. Prices remain unchanged for imported material at $57.00, bagged, untagged, at the ports, and $51.00 bagged, untagged, for domestic material f.o.b. Hopewell, Va.

Industrial News

New Products *New Plants* *New Appointments*

Hough Promotion

Milton J. Weber has been appointed vice president in charge of procurement by the Frank G. Hough company.

Weber is a graduate of DePauw

Milton J. Weber

University, Greencastle, Ind., and has been associated with the Santa Fe Railroad, the John Deere Distributor Organization and the J. D. Adams Co.

He went to Hough from the latter concern where he held the position of office manager of the St. Louis Branch.

At Libertyville, he took over control of the purchasing and priority functions for Hough Co.

Scientists Study Resistance Of Insects to Pest Chemicals

By using pesticides with short term toxicity and a combination of chemicals rather than a single insecticide, two Connecticut scientists may have found a solution to the problem of resistance of insect pests to chemicals used to control them.

Attention was focused on the problem of insect resistance several years ago when DDT became less and less effective for fly control in some areas. The phenomenon also has been noted with other insects, most recently in Korea where DDT effectiveness against lice has dropped.

The scientists, Dr. Raimon L. Beard and Neely Turner, of the Connecticut Agricultural Experiment Station, have added considerably to the knowledge about the causes of resistance.

It had been believed, until recently, that hardier insects survived sprays and produced offspring which also were resistant. The theory continued that after the process had been repeated for several generations a highly resistant strain of insect was developed and insecticide efficiency dropped markedly.

Dr. Beard reports that experiments have shown insects are not fixed in their resistance to insecticides. According to his research, an individual insect may be highly resistant to an insecticide one day and easily killed by it a few days later. He said it has been found that an insect can be anesthetized and recover slowly on one occasion and be extremely difficult to knock-out and recover quickly the next time.

The scientists have found that by avoiding the use of chemicals which remain toxic for a long time after application they can circumvent the problem. The men said the validity of the theory is borne out by the fact that farmers did not have trouble with resistance when they depended wholly on insecticides of the temporary type such as rotenone and nicotine.

Similarly, by using a combination of chemicals, chance of resistance build-up is diminished, because an insect resistant to one chemical is not necessarily resistant to another.

Tests at the Connecticut station have shown that two weak insecticides give as high a kill of insects as one strong one. Experiments now are aimed at finding good combinations for commercial use against specific pests.

Company Seeks Incorporation

Articles of incorporation recently were filed by Gem Monazite Mines of Boise, Ida., capitalized at one million dollars, by John Bastida, John Karriatua, John H. Reusser, Earle Pack and K. N. Jackson, all of Boise.

NPA Sends Reporting Forms to Sulfuric Users

National Production Authority has sent reporting forms required under sulfuric acid order M-94 to 250 suppliers and 2,500 acid users.

Any supplier or user who did not receive a form and instructions for its use should obtain one at the nearest NPA regional office.

Suppliers must give information on production, inventories, orders and proposed deliveries on Form NPAF-162.

Users must complete NPAF-161 on end uses, NPAF-160 on inventories and receipts and NPAF-159 on uses during the calendar years 1950 and 1951, according to NPA.

Soda Springs, Idaho Now Is Big Phosphate Center

Soda Springs, Idaho, considers itself fortunate in being the seat of extensive phosphate developments by the Monsanto Chemical company.

The firm is building its first 30,000 kilowatt electric furnace there, the largest of its kind in the world. It will be finished this year.

The county and the company have built seven miles of highway to the open cut mine.

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Industrial News

3-1 New Acid-Resistant Glove

Safety-conscious personnel in farm chemicals industries should be interested in a new long-wearing work glove which sheds moisture and resists chemicals better than rubber.

The glove, which can be used as protection against concentrations of all acids, including sulfuric acid and oleum, wears like leather but costs little more than canvas gloves, according to a bulletin of the Mine Safety Appliances company.

The glove is coated with a vinyl-plastic substance which stays flexible in extreme cold, does not become sticky at high temperatures and is effective in combatting strong acid concentrations.

Fur further information, fill out a **Reader Service Card,** using number **3-1.**

Phosphate Deposits Bought

Williams Phosphate Corporation has purchased Mountain Meadow Phosphate deposits on Ruby River, near Alder, Mont. A drift has been run on the hanging wall of the vein, which will be extended 1,000 feet.

Limestone Production

The Black Hills and Badlands Association survey of minerals produced in the Black Hills of South Dakota in 1951 reveals that lime and limestone valued at $978,629,000 were dug.

General Petroleum Plans Plant

Defense Production Administration has given tax amortization certificates to General Petroleum corporation of Worland, Wyo., for a $4,220,000 sulfur and processing plant.

3-2 Ammonia Transfer Unit

An important new unit for the transfer of ammonia from the tank car to the storage car has been developed by Worthington Pump and Machinery corporation.

The manufacturer states that its LPG-A Transfer Unit not only will transfer the ammonia but also the residual vapors in the car.

The importance of this added feature is shown in the company's claim that residual vapors often left in tank cars under other means of transfer are equivalent to 800–1,200 gallons of ammonia per car.

For additional information on the ammonia transfer unit, fill out a **Reader Service Card,** using number **3-2.**

Industrial News

Machines Help in Fertilizer Placing

Methods for the best use of fertilizers to get the greatest crop yields from U. S. farms are being developed by agricultural engineers of the USDA

The USDA reports that more than 40 experimental fertilizer-placement machines, each of distinctive design, have been developed.

They have been used by the engineers in cooperation with soil and plant scientists in nearly 800 fertilizer placement experiments conducted with 41 crops in more than half the states. The machines usually are attached to an ordinary tractor.

The department states that tremendous increases in food and fiber production in the United States have been helped by use of the machines. This is indicated by 20 per cent increases in yields of corn, cotton, potatoes, and tobacco, gained by precise placement rather than broadcasting of fertilizer.

In 12 typical experiments in western Washington with different vegetable crops, localized side placement of fertilizer, as compared with broadcast applications, increased yields an average of 47 per cent.

The machines also have led to the development of superior designs for chemical fertilizer application equipment now serving farmers.

Ag Specialists Needed For USDA Overseas Work

Agricultural specialists in certain fields are needed to represent the United States overseas in technical cooperation programs, the USDA has announced.

Specialists are needed especially in the Near East and Southern Asia. Greatest needs are for extension and agricultural education specialists, the department announced. A number of positions for specialists in agricultural engineering, animal husbandry, entomology, plant pathology, horticulture, soils and agronomy also are needed.

Applicants are not required to take Civil Service examinations. They must meet high qualification standards established for the positions, however.

The USDA said interested persons who are qualified by training and by several years' professional experience in agriculture should submit Form 57, Application for Federal Employment, or write to the Office of Personnel, USDA, Washington 25, D. C.

Approximately 500 U. S. agricultural technicians now are doing technical cooperation work abroad.

Industrial News

Pennsalt Producing New Pesticide Called 'Knox Out'

A multi-purpose insecticide, Knox Out Farm Insecticide, has been added to the Pennsylvania Salt Mfg. Co. line of farm chemicals. Containing 25 per cent lindane the material is designed for farm and home use.

Sold as a powder and applied as a spray, it contains wetting agents that permit quick mixing with water.

Knox Out has proved successful for insect control in dairy barns, milk houses, poultry houses, hog pens, manure piles and in direction application on cattle. It is effective also in controlling insects on garden plants, trees and shrubs.

The material is being marketed through retail stores in eight ounce cans and is offered for sale both in the United States and foreign countries.

Sulfur Plant Sought

Hopes for location of a sulfur plant at Powell, Wyo., have gone into discard, temporarily at least. Officials of Rayonier, Inc., a paper company with three plants, have changed their minds about building a sulfur processing plant on Seaboard Oil Company holdings at Powell.

The Greater Wyoming committee is reported urging Rayonier, Inc., to change its mind again about building at Powell.

Industrial News

Labor Department Reports Fertilizer Plant Violations

Sixty-eight per cent of plants investigated in the fertilizer industry during 1951 were found to have violated the Fair Labor Standards Act's minimum wage, overtime pay or child-labor provisions.

Statistics released recently by the U. S. Department of Labor indicate there is room for improvement in the industry.

William R. McComb, administrator of the Labor Department's Wage and Hour and Public Contracts Divisions, said the 1951 record "makes it clear that greater efforts on the part of some members of the fertilizer industry would pay off in reduced liabilities for back wages owed employees."

McComb's report showed that a total of $10,089 in back wages was paid to 169 employees as a result of the Division's work. This does not include funds awarded by courts to workers who sued for back pay and liquidated damages.

"Although most employers know that the amendments raised the minimum wage to 75 cents an hour from 40 cents, the Division found that a sizeable minority of establishments—23 per cent of those investigated—had failed to observe this requirement when paying some of their employees," he said.

"Even more extensive were overtime pay violations, found in 63 per cent of the investigated establishments. Employers should remember that the amended Act continues to require payment of at least time and one-half the employee's regular rate of pay for all hours worked in excess of 40 in the work-week, except where the Act specifically provides otherwise. What the amendment did was to define the regular rate to include all remuneration for employment except certain specified payments."

In five per cent of companies investigated, McComb reported, failure to comply with the Act's child-labor provisions was disclosed.

According to the Act, a minimum age of 16 for most jobs and 18 for hazardous occupations is set forth. Under certain conditions—in office and sales work—employment of persons 14 and 15 years of age is permitted.

The great majority of employers intend to comply with the provisions of the Act, the administrator stressed.

In most cases, he said, failures are caused by misunderstandings concerning regulations.

Any employer in the industry who has questions about the Federal Wage and Hour Law is invited by McComb to inquire at the nearest regional office of the Division.

These offices are located in the following cities: Boston, New York, Philadelphia, Birmingham, Cleveland, Chicago, Kansas City, Dallas, San Francisco and Nashville.

Wyoming Gulf Stockpiles Sulfur at Cody Pilot Plant

The sulfur situation in Wyoming is encouraging but not quite as well developed as several Wyoming communities could wish. Several hundred tons of the material are being stockpiled by Wyoming Gulf Sulphur corporation's pilot plant west of Cody.

This sulfur has a rating of close to 90 per cent and is being piled at a general rate of 12 tons a day.

Industrial News

Richardson Heads New Calumet Office

E. G. Richardson heads a new district office serving the agricultural market opened in Orlando, Fla., recently by Calumet and Hecla Consolidated Copper Company.

Richardson has been appointed Agricultural Field Engineer.

Associated with the citrus and vegetable growing industries in Florida for more than 25 years, he has represented the Florida Agricultural Supply Company and has been an independent manufacturer and distributor of agricultural supplies.

E. G. Richardson

Richardson will have headquarters at Orlando, Fla.

The new office will distribute the company's special grades of copper oxide for use in fertilizers, fungicides and animal feeds.

Calumet and Hecla, one of the country's oldest producers of copper, has worked with state and federal agricultural experiment stations. It produces special grades of copper oxides for agricultural uses.

Wanted: Reliable and experienced manager for fertilizer division. Know buying, formulation and plant operations. State salary expected. Address "360" care FARM CHEMICALS, Philadelphia 7, Pa.

DPA Stops Rapid Tax Amortization Certificates

No more certificates for rapid tax amortization will be issued by the Defense Production Administration. This change which applies except when the certificate certifies a project before construction starts went into effect March 1.

The new regulations were announced by James F. King, deputy administrator of DPA.

Current rules will be applied to tax certificate applications now at DPA or filed before March 1.

The principle of "predetermination" used by the administration means DPA must determine the shortage and essentiality prior to the beginning of certain construction or installations.

The rule applies to all construction and permanent installations estimated to cost more than $100,000, not started before March 1.

Mexico Experiments With Chaff Conversion

The first experiments to convert wheat chaff into commercial fertilizer are being undertaken in Mexico at the Practical Agriculture School of Michoacán, subsidized by the Department of Agricultural Education of the Department of Public Education.

The experiments are being conducted by Ignacio Paredes Castilla, who is supervising a group of technicians of the "Humo Hormona" company.

In addition to wheat chaff, experiments will be attempted with other organic waste products to obtain artificial fertilizers to meet the needs of the country.

SACKETT FERTILIZER PROCESSING SYSTEMS PAY OFF

CONTROL PANEL

These fast fertilizer processing systems have reduced production costs in some plants as much as 65% . . . An estimated cost savings included with a Sackett survey of your production operations may even exceed this figure.

SACKETT ONE MAN BATCH-WEIGH SYSTEM

1. liminates waste of manpower.

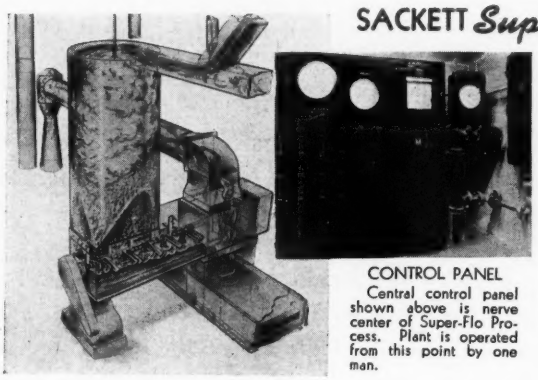
2. Fast-acting weigh valves and printed weigh record provides more rapid and accurate weighing.

3. Circular design of storage hopper accelerates flow of ingredients through weigh valves . . . no corners or valley angles to retard flow of material.

4. Its compact design permits installation in existing buildings with minimum alterations.

5. The installation of this system does not, in any way, disturb existing mixing facilities.

Built in four sizes, 25 tons to 100 tons per hour.



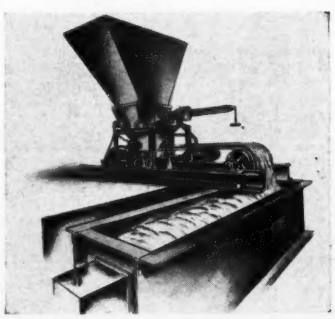
CONTROL PANEL
Central control panel shown above is nerve center of Super-Flo Process. Plant is operated from this point by one man.

SACKETT *Super-Flo*... A CONTINUOUS SUPERPHOSPHATE MANUFACTURING PROCESS

This new Sackett-conceived and developed process produces a superphosphate of premium quality in either powdered or granular form. Its complete mechanization and centralized panel control brings to the industry entirely new conceptions of high production speeds, low manufacturing costs and quality product control.

These Sackett patented processes are built in three sizes, 25 tons to 75 tons per hour.

Exclusive suspended acidulation produces highly converted superphosphate of excellent quality.



SACKETT CONTINUOUS AMMONIATING SYSTEM

The patented Sackett Continuous Ammoniation System is now being offered in four sizes with capacities ranging from 25 tons per hour to 100 tons per hour. This highly efficient method of ammoniating superphosphates and mixed goods with solutions offers many important advantages and is easily installed in connection with existing basing equipment. Higher ammoniation rates are made possible by its accurate proportioning of solids and solutions and lower reactive temperatures due to its exclusive aerating action which takes place during ammoniation. This system is also built in pressurized design for anhydrous ammonia or solutions having high vapor pressures.

SACKETT
BALTIMORE

America's Foremost Designers and Builders

SUPERPHOSPHATE PLANTS • FERTILIZER MIXING PLANTS • RELATED PRODUCTION EQUIPMENT

THE A. J. SACKETT & SONS CO., 1707 S. HIGHLAND AVENUE, BALTIMORE 24, MD.

Architects and Manufacturing Engineers to the Fertilizer Industry since 1897

Producing Nitrogen At Full Capacity!

Phillips is producing nitrogen fertilizer materials at full capacity. But even our tremendous rate of production isn't always sufficient to meet today's demand. We'll do our best for you. Keep us in mind if you need nitrogen in any form.

AMMONIUM SULFATE—Phillips *66* Ammonium Sulfate is a free-flowing 21% nitrogen material! Mixes easily! Uniform crystals resist caking! Ideal for high-analysis mixed goods! A fine direct application material!

AMMONIUM NITRATE—Phillips *66* Prilled Ammonium Nitrate contains 33% nitrogen. The small, coated prills or pellets resist caking . . . handle easily. Phillips *66* Prilled Ammonium Nitrate can be depended on for uniform, free-flowing properties and top-notch crop response.

NITROGEN SOLUTIONS—More N per dollar! Phillips *66* Nitrogen Solutions are well suited to the preparation of high-analysis fertilizers and the ammoniation of superphosphate. These three nitrogen solutions keep handling costs low . . . promote rapid, thorough curing!

ANHYDROUS AMMONIA—Tank car shipments of Anhydrous Ammonia (82% nitrogen) go out to Phillips contract customers from Phillips production facilities in the Texas Panhandle. Write our nearest district office for full information.

Phillips 66

PHILLIPS CHEMICAL COMPANY

A Subsidiary of Phillips Petroleum Company

FERTILIZER SALES DIVISION • BARTLESVILLE, OKLAHOMA

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OMAHA—WOW Bldg. • AMARILLO—First National Bank Bldg. • LOS ANGELES—4521 Produce Plaza West • BARTLESVILLE—Adams Building

How You Can Get

Free Information

On each of the two postage-paid postcards below you can request further information on four items described on this and the Industrial News section of this issue. *Fill out one quarter section for each item in which you are interested.*

3-3 Pesticide Concentrates

An up-to-date compilation of data related to the practical requirements in the insecticide fields is included in a bulletin just issued by Emulsol corporation. It's called "Agricultural Chemical Formulators Manual of Pesticide Concentrates."

3-4 Mix-Muller

Because they embody the true mulling principle of mixing, the company claims, Simpson Mix-Muller installations are the best available for mixing jobs. Simpson machines use an action similar to the rubbing, kneading and smearing of a mortar and pestle. The machine consists of a circular stationary pan in which is mounted a special combination of mullers and plows which revolve.

The mullers are adjustable and are supported on rocker arms so they are free to ride on the material, creating pressure and an intensive rubbing and smearing action as they revolve. This eliminates balling of material and quickly develops a maximum plasticity of the mix.

3-5 Fire-Fog Sprinklers

Chemical processing industries can be safeguarded against fire hazards that ordinary methods of fire protection do not eliminate if Automatic "Fire-Fog" sprinklers are installed, the manufacturer asserts. Most manufacturing plants have certain areas of extreme fire hazard that are hard to protect by standard practices. That's where "Fire-Fog" is useful. Maximum in personnel and fire safety, preservation of high-valued equipment and continuity of plant operations is assured by having the sprinklers on hand in case of trouble, literature on the sprinklers states.

3-6 Micromaster Feeder

Even stubborn, dry material will flow

Here is a list of the NEW PRODUCTS and BULLETINS described on this and the Industrial News pages of this issue giving their monthly code number.

- 3-1 Work Glove
- 3-2 Ammonia Transfer
- 3-3 Pesticide Concentrates
- 3-4 Mix-Muller
- 3-5 Fire-Fog Sprinklers
- 3-6 Micromaster Feeder
- 3-7 Ucilon Coatings
- 3-8 Acid Pumps
- 3-9 Rietz Disintegrator
- 3-10 Koppers DBPC
- 3-11 Thermoid Belts
- 3-12 Insecticide Esters
- 3-13 Pipe Fittings
- 3-14 Dust Filter
- 3-15 'Pony' Mill

FILL OUT READER SERVICE CARDS

FARM CHEMICALS Code Number
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Company
Co. Address

FARM CHEMICALS Code Number
Name
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FARM CHEMICALS Code Number
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Co. Address
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FARM CHEMICALS Code Number
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Title
Company
Co. Address

FARM CHEMICALS Code Number
Name
Title
Company
Co. Address

FARM CHEMICALS Code Number
Name
Title
Company
Co. Address
52-

at the right rate to get maximum production without overloading if a Draver "Micromaster" Feeder is used, the company states. The feeder ends the danger of choke-up, wasted power, inefficient operation and undue wear on sifters, grinders, elevators and conveyors, according to literature on the product. The Draver line includes more than 100 models with capacities ranging from minute quantities to 1000 cubic feet an hour.

3-7 Ucilon Coatings

With equipment getting harder and harder to replace, it is important that corrosion losses be cut. They can be, if Ucilon Protective coatings are used, the manufacturer claims. The coatings protect equipment from attack of many strong chemicals and corrosives, according to a recently issued bulletin. The coatings contain corrosion fighting ingredients noted for chemical resistance—among them, vinyl, phenolic, chlorinated rubber or fish oil base materials. Primers and undercoats are available where individual applications require them the bulletin states.

3-8 Acid Pumps

Impressive production records are being made in many industrial plants in the low-cost handling of acids, corrosives, hot liquids, mild abrasives and other solutions. This has been done by installation of Wilfey Acid Pumps, the company asserts. The pumps are available in 10- to 2,000 G.P.M. capacities with 15- to 150 foot heads and higher. Wetted parts are of practically all machinable alloys, a bulletin explains. Plastic lined models of the pumps are available.

3-9 Rietz Disintegrator

The Rietz Disintegrator has had excellent application in the insecticide industry, the company states. In one use, final delumping and blending following batch ribbon mixers at capacities in excess of 9,000 pounds an hour was accomplished using a 30 HP disintegrator. Quality improvement and reduction in preliminary batch mixing time resulted from the installation. Information on the company's equipment is described in a recent bulletin.

3-10 Koppers DBPC

If you are interested in the prevention of oxidation and deterioration of insecticide compositions containing pyrethrin, you might consider using Koppers DBPC, a highly effective anti-oxidant. In a new bulletin the company explains that DBPC inhibits oxidation processes, thus prolonging potency of the insecticide. Pyrethrin, it is explained, has a marked tendency to decompose on exposure to light or air. DBPC is a crystalline, trialkylated phenol, easily soluble in common organic solvents.

3-11 Thermoid Belts

Even "belt-killing" transmission jobs don't faze Thermoid Transmission belts, the company claims in a descriptive booklet on the belts. Belts are available for all transmission jobs. For severe service, or for high speeds with small pulleys, a High Speed "R" belt with extra strong, hard 35-oz. duck and top grade rubber is indicated, the booklet states.

3-12 Insecticide Esters

Applications of esters in the insecticide industry are described in a new issue of the booklet "Esters by Glyco." The 24 page brochure gives tables of physical and chemical specifications of the nonionic polyhydric alcoholic fatty acid esters.

3-13 Pipe Fittings

If your plant has corrosion problems, they might be solved by installing long-lasting steel pipe fittings. Camco Products company describes its line of fittings in a new catalog.

Included are screwed caps, couplings, plugs, bushings and unions up to and including two inch I.P.S. All are machined from solid bar stock, the booklet states. The fittings are sold at the same price as competing 150 pound cast fittings and can be used where working pressures of up to 1,000 pounds are experienced.

3-14 Dust Filter

There are five reasons why the Day "AC" Dust Filter provides more efficient filtering for many chemical dusts. In a new bulletin of the manufacturer, these reasons are given as 1. continuous-automatic operation, 2. special fit filter cover, 3. outstanding adaptability, 4. no dust catching ledges and 5. separated dust streams. The filter offers 99.998 per cent collection efficiency, the company states, with no shutdowns necessary for cleaning.

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Sec. 510, P. L. & R.
Philadelphia, Pa.

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No Postage Necessary if Mailed in the United States

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FARM CHEMICALS
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Philadelphia 7, PA

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BUSINESS REPLY CARD
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FARM CHEMICALS
317 North Broad Street
Philadelphia 7, Pa.

Complete Service

Lion Provides Dependable One-Stop Nitrogen Service for Fertilizer Manufacturers

Lion Nitrogen Fertilizer Materials:

LION ANHYDROUS AMMONIA— Manufactured in Lion's modern plant, to an 82.25% nitrogen content under accurate chemical control, the uniformity and high quality of this basic product are assured.

LION AQUA AMMONIA— This product is available to manufacturers for use in the formulation of mixed fertilizers or for sale as direct application material. Normally about 30% ammonia, its content can be controlled by order to suit your needs.

LION NITROGEN FERTILIZER SOLUTIONS— Made specifically for the manufacturing of mixed fertilizers, these products supply both ammonia nitrogen and nitrate nitrogen in the ratios desired. They are easily handled and available in three types designed for varying weather conditions, and for formula requirements in the production of fertilizers that cure rapidly, store well and drill evenly.

LION AMMONIUM NITRATE FERTILIZER— The improved spherical white pellets in this product contain a guaranteed minimum of 33.5% nitrogen. They flow freely, resist caking and store much better. Lion Ammonium Nitrate Fertilizer is shipped in 100-pound, 6-ply bags with two moisture-proof asphalt layers.

LION SULPHATE OF AMMONIA— This new, superior-type sulphate is guaranteed to contain a minimum of 21% nitrogen. Through special conditioning of the larger crystals, moisture and free acid content is greatly reduced. These factors, together with the special coating applied, make for greater resistance to caking in shipment or in storage. This product flows freely. It is shipped in bulk and in 100-pound, 6-ply bags laminated with asphalt.

Serving Southern States

Technical advice and assistance to fertilizer manufacturers in solving their manufacturing problems is available for the asking.. just write.

LION

LION OIL COMPANY

Chemical Division • El Dorado, Arkansas

Buyers' Guide

Classified Index to Advertisers in 'Farm Chemicals'

AGRICULTURAL CONSULTANTS
Bailey & Lerch, Washington, D. C.

ALDRIN
Ashcraft-Wilkinson Co., Atlanta, Ga.
General Chem. Div., Allied Chem. & Dye Corp., N. Y. C.

AMMONIA—Anhydrous and Liquor
Barrett Div., Allied Chemical & Dye Corp., New York City
Commercial Solvents Corp., New York City
Lion Oil Co., El Dorado, Ark.
Mathieson Chem. Corp., Baltimore, Md.
Phillips Chemical Co., Bartlesville, Okla.
Spencer Chemical Co., Kansas City, Mo.

AMMONIUM NITRATE
Ashcraft-Wilkinson Co., Atlanta, Ga.
Lion Oil Co., El Dorado, Ark.
Phillips Chemical Co., Bartlesville, Okla.
Spencer Chemical Co., Kansas City, Mo.

AMMONIUM PHOSPHATE
Monsanto Chem. Co., St. Louis, Mo.

AMMONIUM SULFATE
See Sulfate of Ammonia

BAGS—Burlap
Bemis Bros. Bag Co., St. Louis, Mo.
Mente & Co., Inc., New Orleans, La.
Virginia-Carolina Chemical Corp., Richmond, Va.

BAGS—Cotton
Bemis Bro. Bag Co., St. Louis, Mo.
Mente & Co., Inc., New Orleans, La.
Virginia-Carolina Chemical Corp., Richmond, Va.

BAGS—Multiwall-Paper
Bemis Bro. Bag Co., St. Louis, Mo.
International Paper Co., Bagpak Div., New York City
Hammond Bag & Paper Co., Wellsburg, W. Va.
Jaite Company, The, Jaite, Ohio
Kraft Bag Corporation, New York City
Mente & Co., Inc., New Orleans, La.
Raymond Bag Co., Middletown, Ohio
Union Bag & Paper Corp., New York City
Virginia-Carolina Chemical Corp., Richmond, Va.

BAGS—Dealers and Brokers
Ashcraft-Wilkinson Co., Atlanta, Ga.
McIver & Son, Alex, M., Charleston, S. C.

BAG CLOSING MACHINES
International Paper Co., Bagpak Div., New York City

BAG CLOSING—THREAD & TWINE
Bemis Bros. Bag Co., St. Louis, Mo.
Mente & Co., Inc., New Orleans, La.

BAG PRINTING MACHINES
Schmutz Mfg., Louisville, Ky.

BAG FILLING MACHINES
Atlanta Utility Works, The, East Point, Ga.
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman Foundry and Machine Co., Aurora, Ind.

BHC AND LINDANE
Ashcraft-Wilkinson Co., Atlanta, Ga.
Commercial Solvents Corp., New York City
General Chem. Div., Allied Chem. & Dye Corp., N. Y. C.

BONE PRODUCTS
American Agricultural Chemical Co., New York City
Armour Fertilizer Works, Atlanta, Ga.
Ashcraft-Wilkinson Co., Atlanta, Ga.
Jackle, Frank R., New York City
McIver & Son, Alex M., Charleston, S. C.
Woodward & Dickerson, Inc., Philadelphia, Pa.

BORAX AND BORIC ACID
American Potash and Chem. Corp., New York City
McIver & Son, Alex. M., Charleston, S. C.
Woodward & Dickerson, Inc., Philadelphia, Pa.

BROKERS
Ashcraft-Wilkinson Co., Atlanta, Ga.
Jackle, Frank R., New York City
Keim, Samuel D., Philadelphia, Pa.
McIver & Son, Alex. M., Charleston, S. C.
Woodward & Dickerson, Inc., Philadelphia, Pa.

BUCKETS—Hoist, Crane, etc.
Hayward Company, The, New York City

CALCIUM ARSENATE
American Agricultural Chemical Co., New York City
General Chem. Div., Allied Chem. & Dye Corp., N. Y. C.

CARS AND CART
Atlanta Utility Works, The, East Point, Ga.
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman Foundry and Machine Co., Aurora, Ind.

CASTOR POMACE
Ashcraft-Wilkinson Co., Atlanta, Ga.
McIver & Son, Alex. M., Charleston, S. C.

CHEMISTS AND ASSAYERS
Gascoyne & Co., Baltimore, Md.
Shuey & Company, Inc., Savannah, Ga.
Wiley & Company, Baltimore, Md.

CHLORDANE
Ashcraft-Wilkinson Co., Atlanta, Ga.
General Chem. Div., Allied Chem. & Dye Corp., N. Y. C.

CLAY
Ashcraft-Wilkinson Co., Atlanta, Ga.

CONDITIONERS
Ashcraft-Wilkinson Co., Atlanta, Ga.
Jackle, Frank R., New York City
Keim, Samuel D., Philadelphia, Pa.
McIver & Son, Alex. M., Charleston, S. C.
National Lime & Stone Co., Findlay, Ohio

CONTROL SYSYEMS
Sackett & Sons Co., The A. J., Baltimore, Md.

CONVEYORS—Belt
Sackett & Sons Co., The A. J., Baltimore, Md.

COPPER SULFATE
Andrews Sales, Inc., W. R. E., Philadelphia, Pa.
Phelps Dodge Refining Corp., New York City
Tennessee Corp., Atlanta, Ga.

COTTONSEED PRODUCTS
Ashcraft-Wilkinson Co., Atlanta, Ga.
Jackle, Frank R., New York City
McIver & Son Alex. M., Charleston, S. C.
Woodward & Dickerson, Inc., Philadelphia, Pa.

DDT
Ashcraft-Wilkinson Co., Atlanta, Ga.
General Chem. Div., Allied Chem. & Dye Corp., N. Y. C.
Monsanto Chemical Co., St. Louis, Mo.

DIELDRIN
Ashcraft-Wilkinson Co., Atlanta, Ga.

DILAN
Commercial Solvents Corp., New York City

DILUENTS
Ashcraft-Wilkinson Co., Atlanta, Ga.

DITHIOCARBAMATES
General Chem. Div., Allied Chem. & Dye Corp., N. Y. C.

DRYERS
Sackett & Sons Co., The A. J., Baltimore, Md.

ELEVATORS—Bucket
Sackett & Sons Co., The A. J., Baltimore, Md.

Buyers' Guide

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Stedman Foundry and Machine Co., Aurora, Ind.

ENGINEERS—Chemical and Industrial
Chemical Construction Corp., New York City
Fairlie, Inc., Andrew M., New York City
General Industrial Development Corp., New York City
Marietta Concrete Corporation, Marietta, Ohio
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman Foundry and Machine Co., Aurora, Ind.
Titlestad Corporation, Nicolay, New York City

FERTILIZER—Mixed
American Agricultural Chemical Co., New York City
Armour Fertilizer Works, Atlanta, Ga.
Davison Chemical Corporation, Baltimore, Md.
International Minerals & Chemical Corporation, Chicago, Ill.
Southern States Phosphate & Fertilizer Co., Savannah, Ga.
Virginia-Carolina Chemical Corp., Richmond, Va.

FILLERS
McIver & Son, Alex. M., Charleston, S. C.

FISH SCRAP AND OIL
Ashcraft-Wilkinson Co., Atlanta, Ga.
Jackle, Frank R., New York City
McIver & Son, Alex. M., Charleston, S. C.
Woodward & Dickerson, Inc., Philadelphia, Pa.

FULLER'S EARTH
Ashcraft-Wilkinson Co., Atlanta, Ga.

FUNGICIDES
American Agricultural Chemical Co., New York City
Andrews Sales, Inc., W. R. E., Philadelphia, Pa.
General Chem. Div., Allied Chem. & Dye Corp., N. Y. C.
Tennessee Corp., Atlanta, Ga.

HERBICIDES
Lion Oil Company, El Dorado, Ark.
Monsanto Chemical Co., St. Louis, Mo.

HERBICIDES—Oils
General Chem. Div., Allied Chem. & Dye Corp., N. Y. C.
Lion Oil Company, El Dorado, Ark.

HOPPERS & SPOUTS
Atlanta Utility Works, The, East Point, Ga.
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman Foundry and Machine Co., Aurora, Ind.

IMPORTERS, EXPORTERS
Armour Fertilizer Works, Atlanta, Ga.
Ashcraft-Wilkinson Co., Atlanta, Ga.
Southern States Phosphate & Fertilizer Co., Savannah, Ga.
Woodward & Dickerson, Inc., Philadelphia, Pa.

INSECTICIDES
American Agricultural Chemical Co., New York City
Andrews Sales, Inc., W. R. E., Philadelphia, Pa.
Ashcraft-Wilkinson Co., Atlanta, Ga.
Commercial Solvents Corp., New York City
Powell & Co., John, New York City
Virginia-Carolina Chemical Corp., Richmond, Va.

IRON SULFATE
Tennessee Corp., Atlanta, Ga.

LEAD ARSENATE
American Agricultural Chemical Co., New York City
General Chem. Div., Allied Chem. & Dye Corp., N. Y. C.

LIMESTONE
American Agricultural Chemical Co., New York City
Ashcraft-Wilkinson Co., Atlanta, Ga.
McIver & Son, Alex. M., Charleston, S. C.
National Lime & Stone Co., Findlay, Ohio

LOADERS—Car and Wagon
Sackett & Sons Co., The A. J., Baltimore, Md.

MACHINERY—Acid Making and Handling
Atlanta Utility Works, The, East Point, Ga.
Chemical Construction Corp., New York City
Monarch Mfg. Works, Inc., Philadelphia, Pa.
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman Foundry and Machine Co., Aurora, Ind.

MACHINERY—Acidulating
Chemical Construction Corp., New York City
Sackett & Sons Co., The A. J., Baltimore, Md.

MACHINERY—Ammoniating
Sackett & Sons Co., The A. J., Baltimore, Md.

MACHINERY—Grinding and Pulverizing
Atlanta Utility Works, The, East Point, Ga.
Bradley Pulverizer Co., Allentown, Pa.
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman Foundry and Machine Co., Aurora, Ind.

MACHINERY—Material Handling
Atlanta Utility Works, The, East Point, Ga.
Hayward Company, The, New York City
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman Foundry and Machine Co., Aurora, Ind.

MACHINERY—Mixing, Screening and Bagging
Atlanta Utility Works, The, East Point, Ga.
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman Foundry and Machine Co., Aurora, Ind.

MACHINERY—Power Transmission
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman Foundry and Machine Co., Aurora, Ind.

MACHINERY—Superphosphate Manufacturing
Atlanta Utility Works, The, East Point, Ga.
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman Foundry and Machine Co., Aurora, Ind.

MANGANESE SULFATE
McIver & Son, Alex. M., Charleston, S. C.
Tennessee Corp., Atlanta, Ga.

MANURE SALTS
Potash Co. of America, New York City

MINOR ELEMENTS
Andrews Sales, Inc., W R., E., Philadelphia, Pa.
Tennessee Corporation, Atlanta, Ga.

MIXERS
Atlanta Utility Works, The, East Point, Ga.
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman Foundry and Machine Co., Aurora, Ind.

NITRATE OF SODA
American Agrictultural Chemical Co., New York City
Armour Fertilizer Works, Atlanta, Ga.
Ashcraft-Wilkinson Co., Atlanta, Ga.
Barrett Div., Allied Chemical & Dye Corp., New York City
International Minerals & Chemicals Corporation, Chicago, Ill.
McIver & Son, Alex. M., Charleston, S. C.
Woodward & Dickerson, Inc., Philadelphia, Pa.

NITROGEN SOLUTIONS
Barrett Div., Allied Chemical & Dye Corp., New York City
Lion Oil Company, El Dorado, Ark.
Phillips Chemical Co., Bartlesville, Okla.
Spencer Chemical Co., Kansas City, Mo.

NITROGEN MATERIALS—Organic
American Agriculture Chemical Co., New York City
Armour Fertilizer Works, Atlanta, Ga.
Ashcraft-Wilkinson Co., Atlanta, Ga.
International Minerals & Chemical Corporation, Chicago, Ill.
Jackle, Frank R., New York City
McIver & Son, Alex. M., Charleston, S. C.
Woodward & Dickerson, Inc., Philadelphia, Pa.

NOZZLES—Spray
Monarch Mfg. Works, Philadelphia, Pa.
Spraying Systems Co., Bellwood, Ill.

PARATHION
Ashcraft-Wilkinson Co., Atlanta, Ga.
General Chem. Div., Allied Chem. & Dye Corp., N. Y. C.
Monsanto Chemical Co., St. Louis, Mo.

PENTACHLOROPHENOL
Monsanto Chemical Co., St. Louis, Mo.

PHOSPHATE ROCK
American Agricultural Chemical Co., New York City
Armour Fertilizer Works, Atlanta, Ga.
Ashcraft-Wilkinson Co., Atlanta, Ga.
International Minerals & Chemical Corporation, Chicago, Ill.
McIver & Son, Alex. M., Charleston, S. C.
Virginia-Carolina Chemical Corp., Richmond, Va.
Woodward & Dickerson, Inc., Philadelphia, Pa.

Buyers' Guide

Classified Index to Advertisers in 'Farm Chemicals'

PHOSPHORIC ACID
American Agricultural Chemical Co., New York City
General Chem. Div., Allied Chem. & Dye Corp., N. Y. C.
Monsanto Chemical Co., St. Louis, Mo.

PLANT CONSTRUCTION—Fertilizer and Acid
Atlanta Utility Works, The, East Point, Ga.
Chemical Construction Corp., New York City
Fairlie, Inc., Andrew M., New York City
General Industrial Development Corp., New York City
Monsanto Chemical Co., St. Louis, Mo.
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman Foundry and Machine Co., Aurora, Ind.
Titlestad Corporatian Nicolay, New York City

POTASH—Muriate
American Potash & Chemical Corp., New York City
International Minerals & Chemical Corp., Chicago, Ill.
McIver & Son, Alex. M., Charleston, S. C.
Potash Co. of America, New York City

POTASH—Sulfate
American Potash & Chemical Corp., New York City
International Minerals & Chemical Corp., Chicago, Ill.
McIver & Son, Alex. M., Charleston, S. C.
Potash Co. of America, New York City

POTASSIUM PHOSPHATE
Monsanto Chem. Co., St. Louis, Mo.

PRINTING PRESSES—Bag
Schmutz Mfg. Co., Louisville, Ky.

PYROPHYLLITE
Ashcraft-Wilkinson Co., Atlanta, Ga.

REPAIR PARTS AND CASTINGS
Atlanta Utility Works, The, East Point. Ga.
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman Foundry and Machine Co., Aurora, Ind.

SACKING UNITS
Sackett & Sons Co., The A. J., Baltimore, Md.

SCALES—Including Automatic Baggers
Atlanta Utility Works, The, East Point. Ga.
Sackett & Sons Co., The A. J., Baltimore. Md.
Stedman Foundry and Machine Co., Aurora, Ind.

SCREENS
Atlanta Utility Works, The East Point, Ga.
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman Foundry and Machine Co., Aurora, Ind.

SEPARATORS—Air
Sackett & Sons Co., The A. J., Baltimore, Md.

SPRAYS
Monarch Mfg. Works, Inc., Philadelphia, Pa.
Spraying Systems Co., Bellwood, Ill.

STORAGE BUILDINGS
Marietta Concrete Corporation, Marietta, Ohio

SULFATE OF AMMONIA
American Agricultural Chemical Co., New York City
Armour Fertilizer Works, Atlanta, Ga.
Ashcraft-Wilkinson Co., Atlanta, Ga.
Barrett Div., Allied Chemical & Dye Corp., New York City
Jackle, Frank R., New York City
Koppers Co., Inc., Tar Products Div., Pittsburgh, Pa.
Lion Oil Co., El Dorado, Ark.
McIver & Son, Alex. M., Charleston, S. C.
Phillips Chemical Co., Bartlesville, Okla.
United States Steel Corp., New York City
Woodward & Dickerson, Inc., Philadelphia, Pa.

SULFATE OF POTASH—MAGNESIA
International Minerals & Chemicals Corporation, Chicago, Ill.

SULFUR
Ashcraft-Wilkinson Co., Atlanta, Ga.
General Chem. Div., Allied Chem. & Dye Corp., N. Y. C.
Texas Gulf Sulphur Co., New York City
Ashcraft-Wilkinson Co., Atlanta, Ga.
Woodward & Dickerson, Inc., Philadelphia, Pa.

SULFUR—Dusting & Spraying
Ashcraft-Wilkinson Co., Atlanta, Ga.
U. S. Phosphoric Products Div., Tennessee Corp., Tampa, Fla.

SULFURIC ACID
American Agricultural Chemical Co., New York City
Armour Fertilizer Works, Atlanta, Ga.
Ashcraft-Wilkinson Co., Atlanta, Ga.
International Minerals & Chemical Corporation, Chicago, Ill.
Lion Oil Company, El Dorado, Ark.
Monsanto Chemical Co., St. Louis, Mo.
McIver & Son, Alex. M., Charleston, S. C.
Southern States Phosphate Fertilizer Co., Savannah. Ga.
U.S. Phosphoric Products Division. Tennessee Corp., Tampa, Fla.
Virginia-Carolina Chemical Corp., Richmond, Va.

SUPERPHOSPHATE
American Agricultural Chemical Co. New York City
Armour Fertilizer Works, Atlanta, Ga.
Ashcraft-Wilkinson Co., Atlanta, Ga.
Davison Chemical Corporation, Baltimore, Md.
International Minerals & Chemical Corporation, Chicago, Ill.
Jackle, Frank R., New York City
McIver & Son, Alex. M., Charleston, S. C.
Southern States Phosphate Fertilizer Co., Savannah, Ga.
U.S. Phosphoric Products Division, Tennessee Corp., Tampa, Fla.
Virginia-Carolina Chemical Corp., Richmond, Va.
Woodward & Dickerson, Inc., Philadelphia, Pa.

SUPERPHOSPHATE—Concentrated
Armour Fertilizer Works, Atlanta, Ga.
International Minerals & Chemical Corporation, Chicago, Ill.
U.S. Phosphoric Products Division, Tennessee Corp., Tampa, Fla.
Virginia-Carolina Chemical Corp., Richmond. Va.
Woodward & Dickerson, Inc., Philadelphia, Pa.

TALC
Ashcraft-Wilkinson Co., Atlanta, Ga.

TANKAGE
American Agricultural Chemical Co., New York City
Armour Fertilizer Works, Atlanta. Ga.
Ashcraft-Wilkinson Co., Atlanta. Ga.
International Minerals & Chemical Corporation. Chicago, Ill.
Jackle, Frank R., New York City
McIver & Son. Alex. M., Charleston, S. C.
Woodward & Dickerson, Inc., Philadelphia, Pa.

TEPP
Monsanto Chemical Co., St. Louis, Mo.
Virginia-Carolina Chemical Corp., Richmond, Va.

TOXAPHENE
Ashcraft-Wilkinson Co., Atlanta, Ga.
General Chem. Div., Allied Chem. & Dye Corp., N. Y. C.

2, 4-D
General Chem. Div., Allied Chem. & Dye Corp., N. Y. C.
Monsanto Chemical Co., St. Louis, Mo.

2, 4, 5-T
General Chem. Div., Allied Chem. & Dye Corp., N. Y. C.
Monsanto Chemical Co., St. Louis, Mo.

UREA & UREA PRODUCTS
Barrett Div., Allied Chemical & Dye Corp., New York City

VALVES
Atlanta Utility Works, The, East Point. Ga.
Monarch Mfg. Works. Inc., Philadelphia, Pa.
Sackett & Sons Co., The A. J., Baltimore, Md.

ZINC SULFATE
Tennessee Corp., Atlanta, Ga.

Alphabetical List of Advertisers

New portable

'Pony' Mill

Farm chemicals manufacturers should be interested in a new "Pony" model mobile mill which can be used to pulverize any dry grindable material to specifications.

The mill, latest in the Mead Mill line, is an impact type pulverizer, disintegration being accomplished by throwing the material against impact surfaces and by impact of the material against itself during the process.

The mill is powered by a one horsepower motor. It has an output of 50–100 pounds an hour.

Size of grind for any material to be pulverized is determined by mill speed and fineness of the screen used.

So that proper type grind can be assured, the company says its mills are partially custom assembled for each user.

For larger pulverizing jobs, the company manufactures mills in sizes ranging from five horsepower with an output of 500 pounds an hour to 30 horsepower with an output of 16,000 pounds an hour.

Construction of all models is either of cast or welded steel.

The company maintains an experimental laboratory for pulverizing any type material sent to it for testing.

For experimentation, one-half to one cubic foot of material generally is needed, along with a smaller sample of the finished grind.

For further information on the "Pony" Mead Mill and the testing service, fill out a **Reader Service Card,** using number **3-15.**

PATTERN OF PREPAREDNESS

Increased production of food is a vital part of the preparedness pattern. It is essential every acre be used and make its contribution to the overall needs.

Grasslands possess a great potential for increased food production and the Green Pastures program offers the greatest chance of achieving the desired results.

POTASH COMPANY OF AMERICA
Carlsbad, New Mexico

GENERAL SALES OFFICE...1625 Eye St., N. W., Washington, D. C.
MIDWESTERN SALES OFFICE...First National Bank Bldg., Peoria, Ill.
SOUTHERN SALES OFFICE...Candler Building, Atlanta, Ga.

potato plants showing magnesium deficiency. The breakd of tissues, like the loss of green color, starts at tip of leaf. Terminal leaflet is most severely affected.

Fifth in a series of six advertisements showing magnesium deficiency symptoms in tobacco, cotton, grapefruit, corn, potatoes and oats.

you can supply magnesium in the most effective way in mixed fertilizers with Sul-Po-Mag®

Water-Soluble
Double Sulfate of Potash-Magnesia

In many crop growing areas, the vital need for an adequate supply of magnesium is becoming increasingly more evident. A great number of farmers have learned from actual experience that when sufficient amounts of this important plant nutrient are applied to magnesium-deficient soils, large acre yields of profitable, high quality crops can be grown.

That is why more and more fertilizer manufacturers are including *Sul-Po-Mag* in the fertilizer they mix for crops grown on magnesium-deficient soils.

Sul-Po-Mag, produced exclusively by *International*, is a properly balanced combination of potash and magnesium, both water-soluble and immediately available to the crops. It is by far the most practical and economical way to supply magnesium in complete plant foods or for direct application. Today *International* is producing more *Sul-Po-Mag* than ever before to fill the growing need for magnesium in this convenient form.

SUL-PO-MAG (Water-Soluble Double Sulfate of Potash-Magnesia)
MURIATE OF POTASH SULFATE OF POTASH

THIS IS WHY GROWING PLANTS MUST HAVE MAGNESIUM

- It is required in the life process which gives plants their green color and keeps them growing.
- Promotes earlier maturity on soils low in magnesium.
- Enables crops to make better use of other plant foods.
- Carries phosphorus to the growing and fruiting parts of the plant.
- Necessary for the development of seed.
- Promotes the formation of proteins in growing crops.
- Stimulates growth of soil bacteria and fixation of nitrogen by legumes.
- Increases the plant's resistance to diseases.

WRITE TODAY FOR YOUR FREE 

COPY OF THIS NEW BOOK

POTASH DIVISION

INTERNATIONAL MINERALS & CHEMICAL CORPORATION
General Offices: 20 North Wacker Drive, Chicago 6